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THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington, D. C.

VOLUME XXV NUMBER FIVE

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THE DEVELOPMENT OF PATIENCE

Better Crops with PLANT FOOD

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VOL. XXV WASHINGTON, D. C., MAY 1941 No. 5

May finds many preparing for—

The Loud Bassoon

Jeff McDermid

I GO to the marriage altar for the second time directly!!? However, I am only playing a backfield position this trip. Be it known (by all these presents) that in spite of my Scotch traits I am *giving away* something *precious*—our eldest daughter! No doubt I shall "beat my breast" as anxiously as the wedding guest of the Ancient Mariner, whose alarm was caused (as I once said in the fifth grade) at hearing the "loud baboon." But since acquiring better working knowledge of musical instruments I should probably adopt a modern version of the classic rhyme: "The roadhouse guest he mixed with zest to the tune of the saxophone."

Yet it is my turn finally to be the host at a wedding feast, with my chief duties consisting of keeping track of the mail-order silverware and preserving my own and the bank balance simultaneously. With little chance for anything stronger than orangeade on tap at the nuptial table, I shall maintain the former with greater ease than the latter.

So I have patiently set down the auspicious date on my somewhat corny calendar, jumbled up betimes quite amazingly with dairy picnics, poultry demonstrations, and fertilizer field days. Our usual clutter of mail matter is now augmented with bids from dress shops, photo studios, and floral decorators—which flatters considerably one whose daily grist comes from grass seed firms,

horse doctors, and silo salesmen. Having this red letter day well in hand and no excuse possible, I shall be obliged to disappoint sundry county agents and corn huskers while I put on the kid gloves and listen for the Lohengrin. But I am quite sure they will permit me this brief relaxation in society and save some of the hard cider and doughnuts for my next trip to the hinterlands.

MY JOB of waiting in suspense and financial trepidation for the blessed hour is nothing to the brisk and ceaseless to-and-froings which Mother and the Gals unleash. They arise earlier than I do come morning, which breaks no record at that. They are flying all about the premises, sampling cloth and poking patterns, fingering engraved stationery, matching ribbons, frisking through the Lady's Book for new ideas, making lists of probable guests and prospective presents, and talking to cooks and caterers about cake and condiments. I feel utterly useless, almost "relegated," if you know what I mean (like something fit for the attic), and can only seek a simpleton's solace in writing about it to you. You have borne so many of my tribulations and cheered me in so many of my triumphs that I find myself once more in another "inflicting" mood.

But then I remember the comforting words of an old mountain pal of mine who told me in tearful confidence that any kind of a nuptial botheration ceremony is far better than a "shotgun" wedding. Just like an economic war is nicer than a shooting one!

When I think of myself leading a blushing bride to the preacher I recall the first bride I ever fell in love with, when I was a kid of six years old. Mother got a bid to sit in one of the pews and add her tears to the general pool. I was not really invited but I sneaked in just the same, out of curiosity to see how old Cal Peters got away with the bridal march. Cal was a local stock buyer more inclined toward overalls and a bullwhip than broadcloth and bouquets. My chief wonder always was how he could happen to be the sire of such a siren.

Well, anyway Cal took it all in his usual stride, shackling along like a bogtrotter, with the Vision gliding beside him. The groom was "a personable young man of much promise," according to the Clarion. He taught commercial college in our town, and the bride was one of his graduates better suited to dictate than to take dictation. She looked heavenly to me then, and with the exception of the lady whom I escorted away from the altar some time ago, no other bride has hit me quite so hard on the left-hand side of my vest.

NOW here I am, somewhat like old Cal after all, a votary of bucolic gods, unused to the social amenities of nuptial parades, and destined to lead my daughter up the selfsame rosy path. I think the last time I took her up to a minister she was going there to receive my name and not some other guy's. I never realized how short the road can be between a christening and a wedding, until I peered into the mirror and verified the mileage on my facial map. And perhaps it won't be so many years before I quit being a grump to become a gramp!

In this age of elopements and out-of-town engagements, we can feel comfortably old-fashioned because our daughter is marrying a man who grew up in our neighborhood. Mother fed him cookies in our kitchen and so we know all about his culinary tastes, and nobody can bring us scandal stories at the eleventh hour to throw a spectre into the feast. We know he is no angel and so we feel he is well fitted to marry our daughter, who never inherited any harps and wings from my side of the house.

Some folks may think it romantic to join hands with a strange family, but I prefer to hitch up with a tribe who has camped in our neck of the woods, and this makes it easier for me to talk back to the in-laws and vice versa.

We have always made room for the youngsters to have their frolics and parties, and despite the handy motor car our juveniles have been led to feel they were welcome to do their courting and cavorting amid familiar scenes. It was like that back when we were young. Courtships were sort of foreordained affairs, connived and encouraged on the sly by clumsy friends and doting parents. Under such circumstances elopements would not only have

been wholly unnecessary but confoundedly ungrateful to the local parson, who sadly needed the extra five bucks in wedding fees.

I recall that it was during one of my few trips to Gotham that I resolved to hang the welcome sign on our front stoop for decent and law-abiding young gents who came with flowers and candy. On a ride atop a windy bus through lower Manhattan I sat beside a couple who made frank and foolish love, like we were wont to do with the gaslights turned out and the old folks snoring. Looking around me I beheld this spectacle repeated at every turn. It seemed to be the public custom in New York to emote openly, just like discussing the AAA is with us in the corn belt.

There's a reason. Parlors are getting scarcer and flats are getting tighter so that sentimental youth is driven to prehistoric methods in its search for mates. Perhaps our courtrooms are overcrowded because our courting rooms are not so plentiful at home as of yore. A chap should get acquainted with a girl he intends to marry in the vicinity of the kitchen and dining room, even if he has to blab a few hours with the old gentleman before he tires him out and drives him bedward. It gives both prospectives the proper perspective. You can look at the family album if you dare, and see some of the baby pictures if she'll let you.

It's better to grow into a family by degrees and get to know the foibles of the parents by frequent observation. Similarly, if I am going to give my blessing to the happy pair, framed in antique finish and ready to hang up in their parlor, I desire to place my bets on a safe horse. I say "horse" because anybody who isn't ready to wear a halter and swing true on the evener is not the kind of individual to make a matrimonial team successful.

Speaking of my "blessing," however, they haven't asked me for it yet. I have it all dusted off and varnished in hopes that they may find it useful. To date all either of them has said was that they intend to get married; so I'm beginning to wonder if blessings are out of date.

FOR nearly a year I have been expecting the young man to call me aside and stammer out his earnest wish to make our family happy. That's the way I have heard it was done, and most of the Dickens and Bronte novels I was raised on were incomplete without a scene between the suitor and the sire. He has somewhat disappointed me in this regard, as the first and only notice I got of the deal was when Mother asked me if I noticed our girl was wearing a new ring. This disturbed me and ruined my speech which I had carefully prepared to deliver in solemnity to the swain when he bearded me in my den. I don't suppose there will be the slightest opportunity for me to make that speech during the ceremony, but I will consult the parson and see how he thinks it would take

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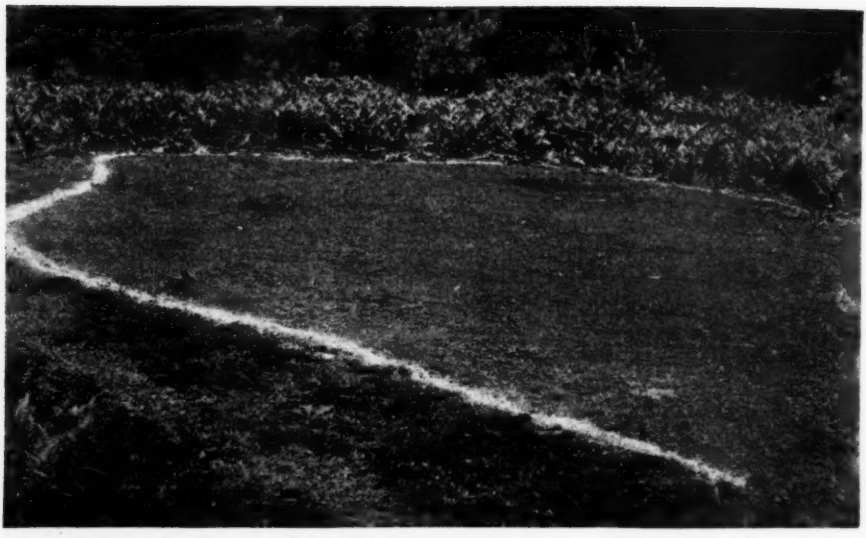

Fig. 1. Vegetative changes on upland pasture from an application of wood ashes produced by a maple syrup evaporator. Within the area marked by lime, the herbage consists of a solid mass of volunteer white clover in contrast with the periphery of moss, ferns, and weeds. Farmers use chemical fertilizers on their pastures in hope of obtaining such desirable changes in vegetation.

Synthetic Wood Ashes Require Boron

By A. R. Midgley and R. E. Dunklee

Vermont Agricultural Experiment Station, Burlington, Vermont

FARMERS in New England, especially in Vermont, boast of their pastures, hay fields, and gardens fertilized with wood ashes. They hoard all that their stoves, furnaces, and maple syrup evaporators produce; sometimes haul them many miles; brave the dirty task of cleaning hot factory chimneys; or pay a considerable price to get them, because they have found them valuable as a fertilizer. Moreover, they are well aware that the ashes must be kept under cover away from rain so that their soluble plant food may not be lost by leaching. A liberal application, one or two tons per acre, often changes a pasture from a mass of brown moss, ferns, and weeds into a carpet of volunteer white clover (Fig. 1). Such changes of vegetation are often phenomenal and often make one think that the ashes directly killed the moss, ferns, and weeds; but it is more likely that desirable plants crowd out the weeds as soon as soil conditions become favorable. While corn, grasses, and other plants are stimulated by wood ashes, alfalfa and clovers in general give the greatest response.

The Romans long ago used wood ashes for fertilizer although they probably were not the first to use them.

Campfire residues must always have left a record behind them in the increased growth of surrounding vegetation, which at one time was erroneously attributed to the burning of the soil. De Saussure proved that ashes from the burned plants were responsible for this increased growth and that the minerals in the plants were obtained from the soil. Liebig, a German chemist, after observing the growth of clover, held that ashes contained all of the elements needed by plants; but Lawes and Gilbert showed that nitrogen was also essential.

In the days of early American agriculture the burning of timber, brush, and stumps previous to plowing provided a generous supply of ashes containing much needed mineral fertilizer. However, when the plant food had been carried away in crops or in drainage water, some soils became non-productive and were then abandoned. In New England a generation or two ago, ashes were so highly esteemed that considerable quantities were imported from Canada when native supplies failed. When German potash salt deposits were developed and potash was sold at relatively low prices, it replaced ashes as a source for this plant food.

Wood ashes contain considerable plant food, especially potash. In fact, the word "potash" is derived from the term "pot ashes" which were obtained by leaching wood ashes with water and evaporating the soluble portion to dryness. Unleached hardwood ashes contain from 2.5 to 12% potash (K_2O) averaging about 6%, from 1.5 to 2% phosphoric acid (P_2O_5), and from 50 to 75% carbonates of lime and magnesia, as well as several minor elements necessary for adequate plant growth. Their soil acidity corrective value approximates 70 to 100% that of limestone. Thus an average ton of unleached hardwood ashes is considered approximately equivalent to 150 pounds of 20% superphosphate, 240 pounds of 50% muriate of potash, and 1,500 pounds of ground limestone. Softwood ashes contain much less plant food, leached ashes still less (under 2% potash), and coal ashes practically none.

Fig. 2. A thrifty stand of alfalfa remained after two years from an application of two tons of wood ashes (right), while a complete alfalfa failure resulted from an equivalent amount of hydrated lime (left). Both plots also received 10 tons of manure and 400 pounds of an 0-20-20 fertilizer per acre.

It is said that Canadian wood ashes carry a lower potash content than formerly, perhaps due to depletion of minerals in forest soils. In spite of the other fertilizing constituents in wood ashes, they are usually bought and sold on their potash content.

Field Trial Conducted

A number of years ago a field trial was conducted on the Windsor Lime Demonstration Farm at Weathersfield, Vermont (Connecticut River terrace). While its object was to determine the kind and amount of lime that could be most successfully used, the data are of interest now because wood ashes were used at two rates. The field was carefully prepared and well fertilized with 10 tons of manure and 400 pounds of 0-20-20 fertilizer. After the lime or wood ashes were applied, they were well harrowed into the soil. In spite of reasonably good care, a poor stand of alfalfa was secured except on the wood-ash plots. The second year an additional 200 pounds of 0-20-20 fertilizer were applied and the field reseeded. No yield data were obtained that year, but the results the following two years are shown in Table 1.

TABLE 1—EFFECT OF WOOD ASHES VS. LIME ON YIELD AND LONGEVITY OF ALFALFA

Treatment	Hay yields per acre on Merrimac s. loam		Alfalfa present 3rd yr.
	2nd yr.	3rd yr.	
	lb.	lb.	%
Wood ashes—1 ton	6,900	4,176	95
Hydrated lime—1 ton	4,666	2,559	65
Wood ashes—4 tons	9,980	4,158	96
Hydrated lime—4 tons	4,990	3,345	25

These results show that wood ashes were very much superior to hydrated lime for the production and longevity of alfalfa, at both the 1- and 4-ton rates. On the wood-ash plots, alfalfa remained for many more years in a good vigorous condition; but without ashes, most of it disappeared after the third year and the few remaining plants showed nutritional disorders, the nature of which was not then recognized. Very similar results were obtained on a Sheldon soil at Colchester, Vermont, from a like experiment conducted at the same time. Here, however, the alfalfa died completely after the second year on all but the wood-ash plots (Fig. 2). No better results were obtained where limestone was used in place of hydrated lime, indicating that the form of lime was not an important factor. In spite of the fact that the fields appeared to be in a reasonably high state of fertility, it was thought possible that the amount and form of potash in wood ashes were the cause of their superiority.

Since potash is considered to be the most important constituent of wood ashes and since this potash is in the form of silicate and carbonate rather than chloride or sulfate, it was thought that the type of potash might be a factor in its availability and assimilation by the plant. Different forms of potash (chloride, carbonate, and silicate) were substituted in tank experiments for the potash contained in wood ashes. An amount of lime and superphosphate equal to that in the ashes was used with the individual potash salts. The average yields of alfalfa for two years are shown in Table 2.

Wood ashes again proved superior to a chemical equivalent of potash, lime, and superphosphate. Since the different forms of potash did not account for this superiority, it seemed evi-

dent that there was some other contributing factor such as beneficial minor elements. Potassium silicate seemed to be better than the other potash forms, probably because it contains more boron which has been found characteristic of calcium and some other silicates.

TABLE 2—EFFECT OF DIFFERENT FORMS OF POTASH SALTS VS. WOOD ASHES ON GROWTH OF ALFALFA ON MERRIMAC SANDY LOAM

Treatment	Average yield per tank
	gm.
Untreated Check	53
Potassium chloride - lime - phosphate (eq. to 2 tons of ashes)	127
Potassium carbonate-lime-phosphate (eq. to 2 tons of ashes)	143
Potassium silicate - lime - phosphate (eq. to 2 tons of ashes)	163
Wood ashes—2 tons	177
Potassium chloride - lime - phosphate (eq. to 4 tons of ashes)	276
Wood ashes—4 tons	425

Within recent years the symptoms of boron deficiency on alfalfa have been recognized and found in marked degree on heavily limed soils. These were especially noticeable in 1940 on the second crop. Because wood ashes overcame these deficiency symptoms, it was assumed that they contained appreciable amounts of boron. This has since been verified by an analysis of 14 samples of wood ashes sent in by county agents. The amount of boron (as borax) per ton of wood ashes, according to the Berger-Truog colorimetric method, is presented in Table 3.

These results show that Vermont hardwood ashes contain a surprisingly high equivalent of borax—averaging about 20 pounds per ton. The figures may perhaps be a little high because of extra dryness of samples (they had been stored in the laboratory for some time), yet the results give a good idea of the amount of boron in wood ashes.

The superiority of wood ashes over equivalent amounts of lime, superphosphate, and potash is held to be due in

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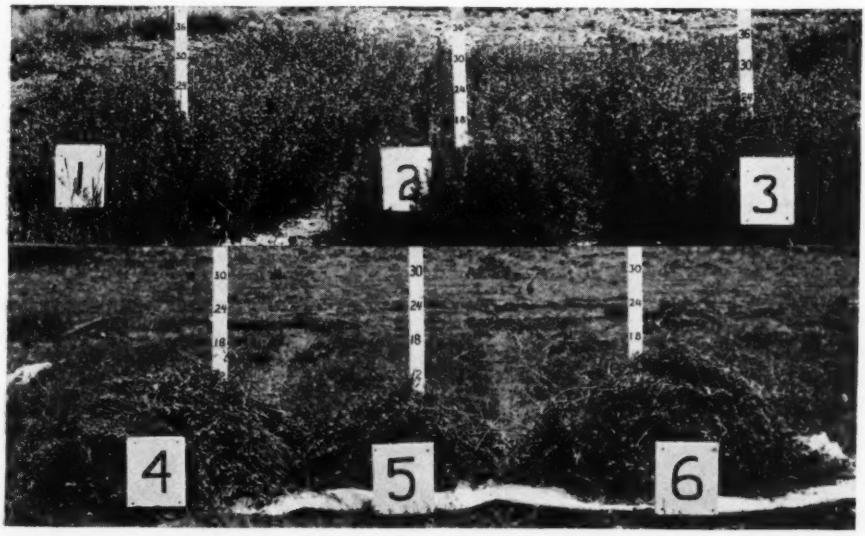


Fig. 3. Alfalfa near Burlington, Vermont, before cutting (1, 2, 3) and the same plots after cutting (4, 5, 6). Fertilizer treatments left to right were hardwood ashes (1 ton); lime, phosphate, and potash equal to the ashes; the latter plus borax. The sparse alfalfa in the middle plot (without borax) produced yellow and bronze terminal shoots in the dry part of the summer. Left for seed in 1940, it failed to set, whereas the other two plots seeded profusely. Much Vermont alfalfa similarly shows signs of needing boron in addition to the ordinary fertilizers.

Florida's Everglades Can Grow Good Cane

By F. D. Stevens

Everglades Experiment Station, Belle Glade, Florida

AGRICULTURALLY, the great tract known as the Everglades of Florida is an exceptionally new country of some 2,500,000 acres of sawgrass peat resting on a solid but semi-porous limerock sheet varying from 6 to 8 feet below in the northern section and outcropping in the southern section along the Tamiami Trail. Underground water, cutting its way through this limerock, accounts for a soil condition bordering on slight acidity to even a neutral reaction.

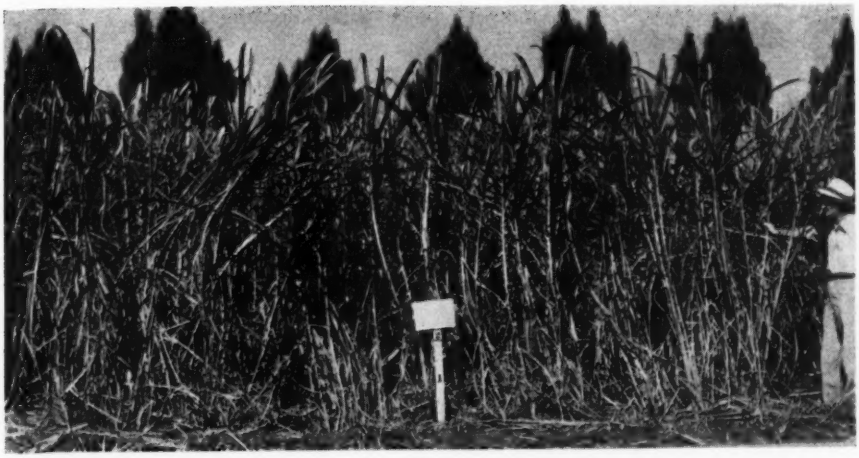
A neutral to slightly acid peat is, so far as is known, formed in but few other areas in the world. In Finland for instance, where there are vast acreages of agricultural peat soils that are acid, the acidity must be corrected to render them productive. Of these peat soils of Finland, the following is interesting. "If peat is saturated with calcium and potassium ions, the potassium ions reduce the acidity more than the calcium ions. The absorbed potassium ions are attached more firmly than the calcium ions, and their influence must, therefore, be more tenacious than that of the calcium ions. Thus it would be advantageous to add large amounts of potash with lime to correct acidity" (1).

On a basis of wet peat, weight of 1,200,000 pounds per acre 6 inches, analyses at this station show a total of 6 tons of calcium. Six tons of calcium per acre six inches definitely marks this peat as needing no corrective measures to "sweeten" the soil for sugarcane production. The expense of such measures, necessary on acid peats to bring them into economic production, is unnecessary here on our Everglades sawgrass peat. This is shown in experiments in which lime at the rate of 1,000 pounds per acre has been used with 300 pounds of sulfate of potash through several crop seasons on such sawgrass peat with no appreciable increase in tonnage or sugar yield over that obtained by the use of potash alone. This could not be assigned to variations due to several sources of experimental error.

Unusual Conditions

The above is but one illustration of the "topsy-turvey" conditions encountered in this vast and largely underdeveloped region, a region which if reclaimed and planted to cane would go a long way toward producing the needed yearly sugar supply of the entire Republic. Present indications point to the fact that even by paying to field workers our American living wage of $2 to $3 per day in harvest, cane can be grown, harvested, milled, and processed with sugar in the bag at a cost on a level with or below that of many tropical cane countries, with their lower standard of living necessitated by low wage standards.

Another peculiar situation encountered in the Everglades is that of the phosphoric acid supply inherent in our sawgrass peat. This is calculated at a total of about 700 pounds, with a dilute acid-soluble supply of close to 75 pounds P_2O_5 per acre 6 inches (4). Removing 1.5 pounds P_2O_5 per ton of mill cane on a 40-ton per acre production, the total would be exhausted with the removal of 12 crops, and the dilute acid-soluble supply would be exhausted by the re-



Second stubble F 31-962, 12th successive crop; fertilizer 75 pounds copper sulfate; yield 13.3 tons per acre: 96 test sugar ton 183 pounds.

moval of one 50-ton crop. A picture of the twelfth successive crop of cane on sawgrass peat is shown in this article.

During this 12-year run, cane has been used successively by plowing out stubble of older, lower-yielding kinds and planting immediately to higher-yielding kinds bred and selected at this station. Land producing this cane has never had phosphoric acid in any form, the crop being made with a yearly application of 300 pounds sulfate of potash, with now and then copper sulfate at 75 pounds per acre. During this 12-year cropping, at least 720 pounds P_2O_5 have been removed in the mill cane, 20 pounds more than analyses show present in new sawgrass peat.

The question arises, are we working the same 6 inches that were put into cultivation 12 years back? Probably not, as many lines run indicate a subsidence of close to one inch per year. Losing one inch of worn-out soil at the top and taking in one inch new soil

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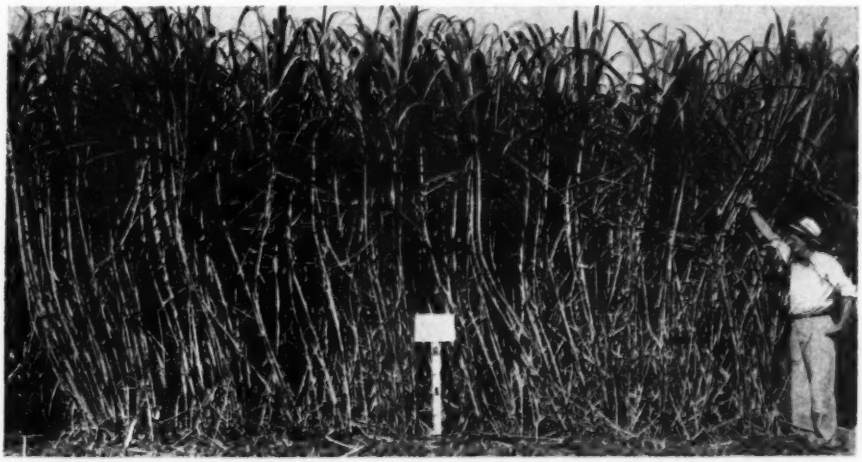

Second stubble F 31-962, 12th successive crop; fertilizer 300 pounds sulfate of potash annually and 75 pounds copper sulfate periodically; yield 39.28 tons per acre: 96 test sugar ton 215 pounds.

Cut-over pine lands in the Pacific Northwest.

Some Early Experiences With Fertilizer on the Pacific Coast

By B. E. Maynard

San Jose, California

¶ *Third of a series of articles recounting personal experiences with the use of fertilizer on the Pacific Coast during the past fifty years.*

UPON accepting a position in 1901 with Victoria Chemical Company in British Columbia, my activities were transferred to an environment in many respects quite different from California. On going out among the farmers, however, I soon found there was much the same prejudice and misunderstanding regarding fertilizers.

From the beginning I had the good fortune to gain the confidence and friendship of farmers in all lines of agriculture, and when calling on them again would be received more as a friend and consultant who had their interests at heart than a salesman whose chief endeavor was to get their names down on the dotted line. Some were of the opinion that all fertilizers were simply stimulants which were only temporary in their effect, and if their use continued for any length of time, soils would become completely impoverished. Other arguments against the use of fertilizers that frequently came up were, "If we start using them, won't we have to keep it up?" and, "Our soils are already so impoverished that there

is nothing left in them for fertilizers to act upon."

These were but a few of the problems which had to be explained in a way that would be clearly understood by the farmer and would not leave him with the impression that there was any attempt to impose upon or mislead him. Many farmers, however, wanted all the information they could get about commercial fertilizers and how to use them to the best advantage. The confidence thus gained resulted in my being called upon to address a number of farmers' meetings on the subject of fertilizers. These meetings were always characterized by many questions from farmers wanting more specific information on some points of interest. On one occasion, being called upon to address a farmers' meeting in the town of Nelson, I had talked but a few minutes when interrupted by a question from someone in the audience. As soon as this was answered, questions began coming in from all sides and I was kept on the platform until nearly midnight.

At times considerable opposition from certain authorities had to be met, since fertilizer usage was a new thing. Officials of the British Columbia Department of Agriculture, however, were always ready with their kindly cooperation and friendly good will. In fact, the Deputy Minister of Agriculture considered the question of fertilizers of sufficient importance to arrange a tour for me through some of the leading agricultural sections of the Province, during which I gave a series of talks on fertilizers and their place in agriculture.

One of the first questions that came up with the Victoria Chemical Company was that of the most suitable formulas to offer in mixed fertilizers. A formula they already had been selling was a 1½-5-3½. On asking why they offered a mixture so low in plant food, I was told that agricultural authorities consulted were of the opinion that it would be impossible to make sales unless they had a fertilizer that could be sold at a low price per ton. The company was in favor of putting out concentrated goods provided the idea could be put over with the farmer.

We then went into the matter of formulas. For the time being I suggested that the 1½-5-3½ be retained, but to let me have the same formula with the filler cut out. As the filler, screened sand, comprised one-half the bulk, this gave a 3-10-7, just double the former strength. We worked out two other formulas omitting all fillers, which as I remember them were a 3-8-12 and an 0-11-12. On getting these, I started out on my first trip which took me through some of the best farming sections of the Province.

More for Their Money

In considering as a filler the use of sand, which had to be screened and dried at considerable expense, and the cost of mixing and extra sacks needed to hold the increased bulk, the manufacturer also was glad to get away from its use. As one farmer put it, "We have lots of sand here without having to pay freight on more, therefore, why include it in our fertilizers?" It is needless to say that the demand for mixtures of low concentration ended with this trip and received no further consideration. Six weeks later, on getting back to Victoria, I did not have a single order for the 1½-5-3½, although a goodly number for the others had been booked. Among these the 3-8-12 predominated, despite the fact that it was the highest in price per ton.

Farmers called upon were advised that they would have to purchase two tons of the 1½-5-3½ in order to get as much plant food as contained in one ton of the 3-10-7, also that one ton of the latter would cost $2 less than two tons of the other. In addition, they would have to pay double freight and other handling charges. Invariably this reasoning led to an order for the 3-10-7. Basing judgment along the same lines, the 3-8-12 met with favor wherever there was an apparent need for potash.

It soon became evident that potash was much needed as a fertilizer in many sections of the Province, particu-

larly in the western sections where the rainfall was heavy. Newly cleared pine lands showed the need for fertilizers from the beginning. At first some thought the unproductiveness of these soils was due to accumulations of turpentine from the pine forests that formerly grew thereon. However, it was soon proved that these supposedly barren lands would respond remarkably to applications of fertilizers. Convincing evidence of the need for potash in the pine lands was found in the wonderful growth wild dewberries would make following the burning over of a slash from which none of the felled timber had been removed. These berries not only grew vigorously, but produced heavy crops unexcelled in quality. The effect, however, was not lasting, as the trees when burned produced a very small amount of ash, which in turn was exceedingly low in potash. Therefore, within a short period of time potash had to be added to the soil.

Before fertilization, grain planted on these soils would often simply sprout then die without making further growth. This action was similar to that of grain sown on peat soils where potash was greatly deficient. The 3-10-7 soon became popular for the growing of hay and grain on these soils, but where additional nitrogen was needed it was supplemented by applications of nitrate of soda. The 4-8-12 met with demand for the growing of potatoes and root crops. Some of these soils were deficient in lime, and liming was necessary for the production of beets. Potatoes, carrots, and strawberries would thrive without it. Although these lands were unproductive at first, they were very responsive to the use of fertilizers alone, and some crops later produced here were equal to the best grown on the rich soils of the Fraser River Delta.

Where the farmer on these newly cleared pine lands depended largely upon dairying for a living, the increased production of hay, pasturage, and other crops due to the use of fertilizers would enable him to add very materially to his herd of dairy cows and to the maintenance of other livestock on his place. This increase in livestock would result in a corresponding increase in the manure produced, which on going back to the land actually meant that a very considerable portion of the fertilizers applied was being used over again. This meant an increase in humus, in which these soils were very deficient. Thus with the addition of moderate applications of fertilizer to replace that contained in the produce sold or otherwise lost off the place, the soils would soon be brought up to and maintained in a high state of fertility.

A Nutritional Disease

During my three years' work in British Columbia, through contacts with apple growers, I was able to make many observations in their orchards. A serious trouble noted in apple trees was a disease known as northwestern apple tree anthracnose or bark canker, which seemed to be confined chiefly to the wetter sections of the West Coast. It soon became evident that liberal applications of organic nitrogen, applied in the form of manures or fish, greatly aggravated this trouble. Apparently these slow acting forms of nitrogen would attain their highest availability in the late summer and early fall months. Instead of the trees hardening up as they should for the winter, growth would be prolonged and the trees would enter the late fall and early winter months in a tender, sappy condition, most susceptible to the attacks of this disease. During this period the greatest number and most destructive cankers appear. Young apple orchards, apparently free from this trouble, if heavily manured with fish or barnyard manure, would grow vigorously during the following summer, but in the fall and early winter would be attacked by this disease in a most virulent manner. On the smaller branches the cankers might become confluent, girdling and causing the death of the branch. From these findings it seemed apparent that the use of

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Demonstration Garden of the College of Agriculture. This garden contained one-half acre and supplied enough vegetables for a family of five.

Garden Most Valuable Acre on the Farm

By A. J. Sims

Agricultural Extension Service, Knoxville, Tennessee

THE most profitable land on the average Tennessee farm, according to studies made by the College of Agriculture and Extension Service over a period of years, is that devoted to the farm garden. Each spring some 200,000 gardens are started on 75 to 80 per cent of the farms of the State. Many of these gardens are productive for only a few months; some provide fresh products for the family table the year round. The gross value of products produced in these gardens annually, excluding commercial vegetable production, amounts to 12 or 15 million dollars, or about 12 to 15 per cent of the gross income from all other crops grown in Tennessee.

Studies made by the College show that half or more of the farm family's food supply may come from the garden. Records kept by several thousand farmers in cooperation with the Extension Farm Management Department over a period of years show that the most successful farmers produce most of the food and feed needed to supply their families and livestock. The value of food produced for use at home, including vegetables, fruits, dairy products, poultry and eggs, meats, and cereal grains, frequently amounts to $400 or $500 annually on the average farm.

On farms where the production of these items for home use is overlooked, it is necessary, at present prices, for the farm to produce the equivalent of 6 or 7 additional bales of cotton, 3,500 to 4,000 pounds of tobacco, or 18 to 20

200-pound hogs to provide cash to purchase these needed items of food. Such evidence as this has convinced many Tennessee farmers of the value of a good garden in recent years.

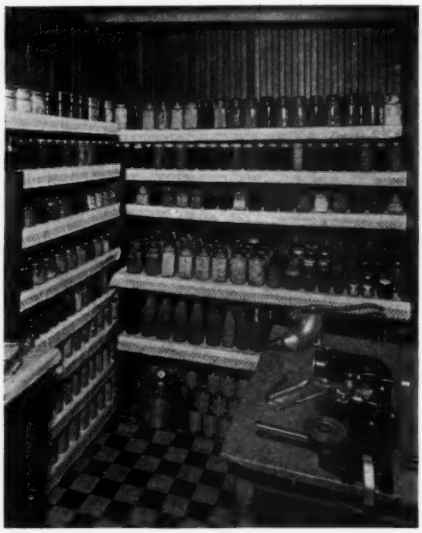
Aside from the fact that few acres on the average farm will bring half as good return from a cash standpoint as a good garden, certainly none will bring as high returns in the health of the farm family. It is now well recognized that many physical and mental weaknesses are traceable to lack of the right kind of balanced diet regularly during the entire year. This reflects itself in many ways in the social, economic, and mental life of the farm family. Most farm families get enough food of a kind, but good living and proper health require more than that.

Nutrition experts tell us there must be a variety and proper amount of the right kinds of foods, including vegetables, fruits, poultry, eggs, milk, butter, and meats. These are required regularly throughout the year. "Nutritional diseases," says an eminent authority of the U. S. Public Health Service, "in all probability constitute our greatest medical problem, not from the point of view of deaths, but from the point of view of disability and economic loss." A recent Gallup poll revealed that 59 per cent of the people interviewed in the Southern States on the question of adequate diets reported that they did not have enough of the right kinds of foods to eat.

Protective Foods

Every food makes a contribution to the diet, but some make more than others. Some are called protective foods, such as milk, green leafy vegetables, and fruits. Recent dietary studies show that the Nation is short on these protective foods—leafy, green and yellow vegetables, 50 per cent; tomatoes and citrus fruit, 25 to 70 per cent; milk, 10 to 20 per cent; and butter, 10 to 25 per cent.

There are wide differences in protein content and in energy values of vegetables, but practically all are important sources of minerals and vitamins. Diets,



Food storage pantries like this are becoming more common in Tennessee farm homes as a result of the State Home Food Supply Program directed by the Agricultural Extension Service.

to be fully adequate for growth and good health, must include liberal quantities of vegetables. In addition to contributing minerals and vitamins, they deserve a special place in the diet because of their laxative properties. They are valuable, also, in giving variety in color, flavor, and texture to the diet. Although fresh vegetables are more desirable, canned or dried vegetables can be used when the fresh supply is exhausted.

All gardens should include a liberal supply of Irish and sweet potatoes, a supply of either dried beans or peas, and an abundance of both tomatoes and cabbage. Irish potatoes, for example, are an important source of energy and iron, while sweet potatoes are very valuable for vitamin A. Dried peas and beans are good sources of protein and also yield considerable energy, iron, calcium, and vitamin B. Tomatoes and raw cabbage deserve special mention as sources of vitamin C. Green leafy vegetables are valuable for iron, vitamin A, and vitamin G. The yellow-colored ones are excellent sources of vitamin A.

In 1940 the crisis of southern "money crops"—cotton and tobacco—underpro-

duction of many foods needed for proper nutrition, lack of full appreciation of the "cash-saving value" of a good farm garden, and the need for a better balance of money crops with the production of food, feed, and soil-fertility crops on many Tennessee farms, led to the development of a State-wide Home Food Supply Program. This program was sponsored by Governor Prentice Cooper with the following agencies cooperating: the State Department of Agriculture, the Agricultural Extension Service of the University of Tennessee, the State Department of Vocational Agriculture and Home Economics, the State Agricultural Conservation Committee, the State Grange, the State Farm Bureau Federation, and the Farm Security Administration.

The objective of this program was to promote better living among all farm families in Tennessee by encouraging the production and preservation of a variety and adequate supply of home-grown foods to provide a healthful, well-balanced diet including vegetables, fruits, meats, milk and butter, and poultry and eggs.

All farmers and their wives, landlords, tenants, sharecroppers, white and colored, were eligible to participate. The program was launched in March, and on May 15, the closing date, 61,693 families had enrolled. At the end of the year all families producing 75 per cent or more of the food supplies necessary for a healthful, well-balanced diet were awarded a handsome, framed "Certificate of Recognition," signed by Governor Cooper. Nearly one-third of the families enrolled qualified for certificates which today can be seen hanging on the walls of many homes, and the recipients take considerable pride in them. Families making the highest score in each county were given a dinner by the Governor and were awarded distinguished merit plaques.

Program Being Continued

The program is being continued in 1941 with all indications that well over 100,000 farm families will be enrolled. Interest and enthusiasm in gardening as a profitable enterprise from a "cash-saving" standpoint and as a means of providing adequate supplies of the right kinds of foods for proper nutrition and health of the family are at a high pitch in all sections of the State as a result of this program which has brought the

This garden and orchard on the S. H. Hart farm, Bledsoe County, indicate that Mr. Hart believes in living at home.

garden, as well as other food products that can be produced on the farm, into the spotlight. The program has attracted the attention and cooperation of the Tennessee Council of Chain Stores, which is assisting in preparations for a "Better Nutrition Week" to be proclaimed by Governor Cooper.

Some 15 years ago garden specialists of the College of Agriculture started an experimental garden on the Experiment Station farm at Knoxville to demonstrate the value and possibilities of the farm garden in contributing to the farm family's food supply. This garden was no petted or pampered thing. It received no more time than the average farm family can afford. It was carefully planned and records were kept for a period of 10 years. It contained one-half acre, and the aim was to produce an adequate supply of vegetables for a family of five. Changes were made in the plan of the garden from time to time as they appeared desirable. All of the vegetables needed to supply an adequate, well-balanced diet were grown. Different varieties were tested, and planting dates, spacing, fertilization, crop arrangement, disease and insect control, harvesting methods, and value of products grown were carefully studied.

It was found that half or more of the farm family's food supply required for a properly balanced diet could be produced much more cheaply than it could be purchased. It was also found that with proper planning and reasonable care one-half acre, or at most three-fourths acre, of land is sufficient to produce an adequate supply of vegetables for a family of five.

While vegetable crops can be grown successfully on a wide variety of soils ranging from those of a rather light sandy nature to the heavy clay types, it was found to be a distinct advantage to have a soil which warms up reasonably early in the spring, one which can be worked rather quickly after a rain, and one which does not bake and form clods easily. These qualities are considered of greater importance than high fertility, because the plant-food materials may be supplied according to the needs of the plants.

Because of the importance of an early spring garden, it is usually wise to plow the soil in the late fall or early winter. If the location is such that there is danger of washing during the winter, and there is no more desirable location available, it may be wise to seed a cover crop in the fall and delay the soil preparation until spring. However, such a plan will usually result in a late start and will cause the garden to compete with other farm work during the busy season. If the soil is fall-plowed and left rough during the winter, the freezes will put it in excellent physical condition and make the cultivation easier during the entire season. The final preparation of the soil by disking, harrowing, and smoothing should be done shortly before the crops are to be planted and should be very thorough.

Fertility Recommendations

The fertility of the garden should be secured by a program of gradual improvement rather than the application of comparatively large quantities of readily available fertilizers at planting time. Such an improvement program should include, as its most important step, the incorporation of large quantities of humus into the soil. If the soil is inclined to be rather light, so that crops suffer quickly during dry weather, the addition of humus will increase water-holding capacity. If the soil is inclined to be heavy, so that it warms up late in the spring and drys slowly after heavy rains, the addition of humus will greatly improve the condition. The application of liberal quantities of manure, where it is available, will add humus and build the fertility of the garden.

If sufficient suitable land is available, it is very desirable to include in the garden an area large enough so that approximately one-third of it may be planted in a soil-improving crop such as crimson clover, vetch, or soy beans

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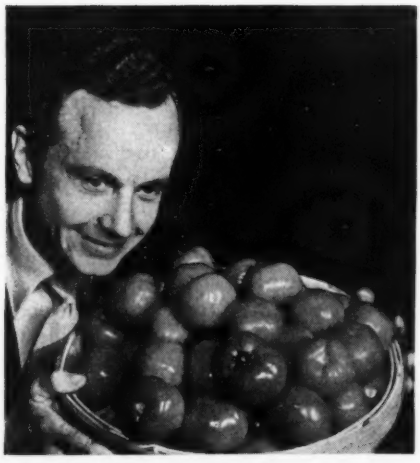
Indiana's Latest Tomato Champions

By Roscoe Fraser

Agricultural Extension Service, Purdue University, Lafayette, Indiana

THE fact that youth leads the way is brought home to us more forcibly every day. Last December a 4-H Club girl won the Grand Championship with her steer at the International Fat Stock Show. The year before, the International Grand Champion Barrow was raised by a boy. Two of the top 10 box office attractions in the movie world are a young girl and a boy. And in the announcements of the 1940 Indiana Tomato Championships, it is noted that the winners are mere youths.

Maurice Johnson, who lives 5 miles northwest of Kempton, is the Indiana "U. S. Won" Tomato Champion Grower for 1940. He is a young man, only 25 years old. The fact that he is the son of Harry Johnson, the 1935 State Winner, may have been of some help to him; but his father assures us that "Bus" actually did all the work connected with the crop, while the father worked on the county roads as assistant supervisor.



Maurice Johnson of Kempton, Indiana "U. S. Won" Tomato Champion Grower for 1940.

Maurice, or "Bus" as he is better known, has been helping his father farm as far back as he can remember. Besides their own 110 acres, they rent 80 acres. Like most Indiana farmers, they feed all the grain they raise to 15 brood sows and their pigs, 4 horses, and 17 cows and steers.

On their 6-acre tomato field they put 55 loads of manure, 80 pounds of granular "Aero"-cyanamid per acre, and 80 pounds of 50% muriate of potash per acre, which was all plowed under in the spring. As soon as the plowing was done, a pole was dragged over the ground to smooth it down.

The last week in April the ground was double disked and 190 pounds of 2-16-8 fertilizer per acre were put on with a big fertilizer drill. Then 100 pounds of 2-12-6 were drilled in with the corn planter, at the same time ½ pound of seed per acre was drilled in with two Planet Jr. garden seeders hitched behind the planter. The stand was so bad because of poor seed germination that the plants were disked up and Bus almost decided not to grow tomatoes.

However, due to the persuasive powers of the fieldman and the fact that there was so much already invested in fertilizer and labor, Bus changed his mind, and on the 5th and 6th of June, set out 21,000 certified Georgia tomato plants after he had disked the ground 3 times more. A ½ pint of starter solution made up of 4 pounds of 16-40-9 to 50 gallons of water was used on each

plant. The plants were set 3′6″ x 3′6″. They were cultivated four times and hoed once.

When picking began Bus hired two neighbors and four transient pickers. If a low grade was reported, he just kept telling his pickers to pick only red-ripe tomatoes. From August 29 to October 4, 13.75 tons of tomatoes per acre were delivered to the Kempton factory. After that factory closed, two

These boys have all been in 4-H Corn Club work, and last year, all had calves in the Calf Club. Last spring, Mr. Miller began thinking about a crop they could handle, one by which they could earn some money for themselves, since he wanted to keep them on the farm. He went to the Roach-Indiana Corporation at Gwynneville to see about getting them into a tomato club, but the requirements for starting a club

Arnold, Vernon, and Virgil Parks of Arlington, Indiana, 1940 winners in the Double Tonnage Club.

tons per acre were sold to an Indianapolis factory. His grade for the season was 85.8% U. S. No. 1's.

This tomato field was the same field where the State Champion tomatoes were grown in 1935. In 1936, it was in corn and in 1937 and '38, in clover and oats. In 1939, corn (100 bu. per acre) was grown here, on which 100 pounds of 0-10-20 were used.

In the Double Tonnage Club, 3 boys share the honors. They are Arnold, 17, Vernon, 15 (both Vocational Agriculture students at Arlington High School), and Virgil, 13, sons of Lester Parks. They live on the 217-acre farm of Mr. Fon A. Miller, 1½ miles S.E. of Arlington, Indiana, only 2 miles from one of the Willkie farms.

are 10 members, with an average of 5 acres each. Ten interested boys could not be found, and so the club could not be organized. The Parks boys decided to raise tomatoes anyhow.

Since this was their first year, they went at it as scientifically as possible. They had the soil tested at a tomato school early in March and followed exactly the instructions of the Purdue extension workers and the fieldman. They had a 3.032-acre field and produced 15.266 tons of merchantable tomatoes per acre. In Indiana, the Double Tonnage Club is for the growers of those canners who buy on a flat rate per ton. The average of 15.266 tons per acre (highest yield produced

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Soil Productivity In the Southeast

By W. H. Garman

College of Agriculture, Athens, Georgia

ALMOST all soil fertility problems can be considered from chemical, physical, and biological aspects. There is little doubt of the fact that we have in the past given considerably more attention to the chemical side of soil productivity than to either the physical or biological, or both combined for that matter.

Our fertilizer consumption alone goes a long way toward bringing out this point. During the past 25 years we have consumed an average of more than 6.5 million tons of commercial fertilizers per year in the United States. This is ample proof that for over a quarter of a century there has been considerable effort directed toward the chemical side of supplying nutrients for crop production. In some sections of the country this effort has found extensive practical application, much greater than in other sections where the inherent chemical nutrient supply in the soils has more nearly supported the predominating agriculture.

If we consider the five Southeastern States, North Carolina, South Carolina, Georgia, Florida, and Alabama, we find that in the three years 1937, 1938, and 1939 there were 11,404,598 tons of commercial fertilizers consumed, or an annual average of 3,801,532 tons. This tonnage amounted to approximately 47 per cent of the entire consumption of the United States. In the same three years the remaining 43 states and the District of Columbia used a total of 11,852,752 tons, or an average of only 149,384 tons more per year than the five Southeastern States. This leaves no doubt as to where the supply of available nutrients in the soils of this country has been most limiting. Yet, is it not possible that in this same section factors other than the amount of available nutrients might be of importance in determining the productivity of the soils? Could it be that we have overlooked the importance of fundamental, physical, and biological phenomena?

If one has any appreciation of physical characteristics of soils (other than the sands of the Coastal Plain) and has had an occasion to travel through the states of certain other regions, it is very apparent that the soils are in no way similar. If this contrast is carried to the laboratory, we might expect to find the answers to these differences which we see. In most instances we would, first of all, find a lower content of organic matter in the southern soils, a lower level of active calcium and magnesium, and a lower pH as well. These, when added to studies with regard to infiltration rates, water-stable aggregates, water-holding capacity, subsoil aeration, and erosion or dispersion ratios, and then to a biological examination of the soil organisms, would surely give more than a little evidence that all of these factors must have undoubtedly played some part in determining the relative natural productiveness of the soils in the respective areas. Consequently, factors other than those which can be considered strictly as available nutrient supply of nitrogen, phosphorus, and potassium must have been at least partially responsible for the concentration of the fertilizer industry in the Southeast. So far, we

have given little attention to these factors in scientific studies and in the application of research information in our agriculture. Perhaps the fertilizer industry itself would be benefited by such studies.

In general, approximately 15 to 30 per cent of the cash income of agriculture in the Southeast goes for fertilizers. This is obviously a large expenditure for any one commercial item, and it is likewise obvious that the farmer would be better off financially if a smaller portion of his income had to be spent for commercial fertilizers. Most of us are agreed that the average farmer uses less plant nutrients than he should, so to use still less would certainly not be economical, at least in most instances. If the net income is to be increased, just what is the most logical, or the more promising method of procedure? To this end there is insufficient speculation in progress today.

Diversification Desirable

One of the first thoughts that comes to our attention is a change in the type of agriculture, not implying a complete change, of course. From the standpoint that diversification of efforts tends naturally toward greater agricultural self-sufficiency, this seems desirable. Whether or not this may be absolutely true and whether it will come about in the future are not to be dealt with in this discussion. It is my present purpose to consider agricultural conditions as they exist today, and attempt to investigate the possibilities of building up farm income through education and land improvement without drastic changes in our agriculture.

As far as acre yields enter into determining income, we in the South have room for improvement. Our average acre yields of corn and small grains are below the national average, and our cotton yields are by no means high. We have need for efforts toward higher yields, but these increases must be economical, that is, they must be made to pay.

Perhaps we have given insufficient attention to factors other than fertilization which place limitations upon soil productivity. Just as surely as an inadequate supply of available nitrogen, phosphorus, and potassium will limit crop yields, so will insufficient active calcium and magnesium, absence of desirable bacteria and fungi, lack of aeration, impervious subsoil, low water intake, low water-holding capacity, low organic matter, and lack or low availability of the so-called minor elements such as boron, manganese, copper, and zinc. In addition, such factors as quality of seed, land preparation, insects, diseases, rainfall, drainage, erosion, depth of soil, humidity, light, and temperature may, and often do, exert profound effects upon plant growth.

It is only too true that much of our soil is low in natural fertility and that vast areas have been extensively exploited through the years of producing cultivated crops, so that today there are hundreds of thousands of acres of formerly good agricultural land which no longer possess a top soil, and thousands of our farmers are in reality what we might term "subsoil" farmers. This loss of topsoil has removed from the soil the most available nutrients which it possessed, as well as a very large part of its organic matter. What these farmers have left to secure their livelihood from is of necessity vastly different from the same fields which their grandfathers knew. With these changes, many new and complicated problems have arisen.

Water alone is of far reaching importance. With the permeability of the soil to water reduced, less of any given rainfall actually finds its way into the soil. This means added surface run-off, which of necessity means greater soil losses, thus accelerating the rate at which conditions are becoming more acute. With the water-holding capacity of soils reduced, crops suffer from unreasonably short periods of drought. In the South, we should not be limited by lack of soil moisture, inasmuch as we

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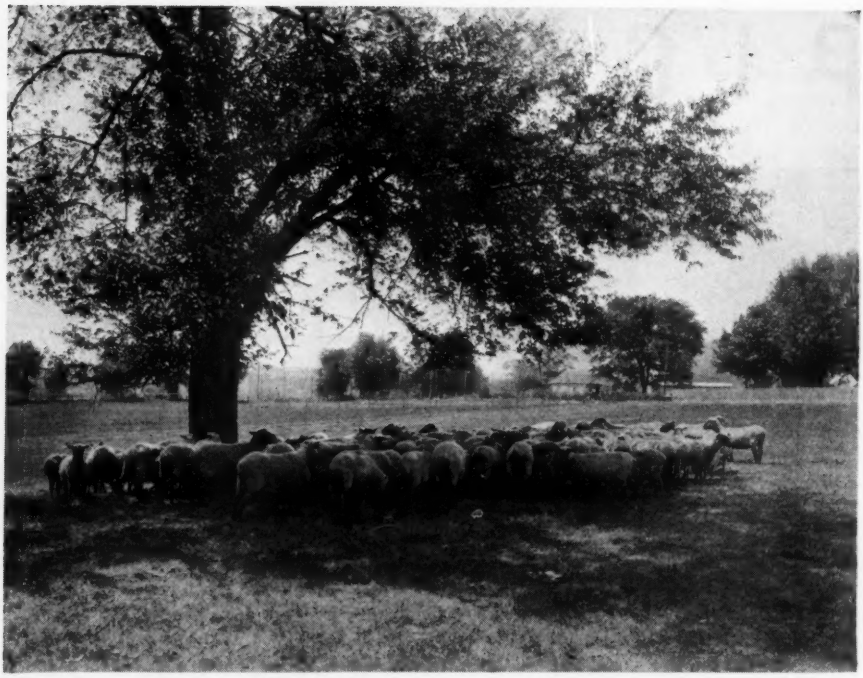
PICTORIAL

A MISSOURI COMBINE—MOWER AND BALER



Above: Sheep, like other animals, enjoy a good shade tree.
Below: The morning rush to pasture for more "raw materials."

Above: Good beef grows fast when pastures are lush and green.
Below: A contented "Belle of the Herd" knee deep in clover.

Above: A quiet and peaceful landscape in the Ozarks.
Below: Sorbus berry trees blooming along an Indiana highway.

The Editors Talk

The Growth of the Topdressing Idea

What has now assumed an importance to justify its being called a new development in the use of fertilizers is the growth of the idea and practice of applying potash as a topdresser. The profitable use of quickly acting nitrogen fertilizers during the growing season has long been known. It has been practiced particularly by the growers of cotton, corn, and small grains in the South and for small grains and leafy vegetables in the North. But the use of potash in this manner is a comparatively recent development, originating apparently in the South, where it was demonstrated that potash applied with the nitrogen topdresser would control cotton rust.

Like most innovations in accustomed farm practices, the nitrogen-potash topdresser "took" slowly. Farmers thought that they were applying enough potash at planting time. The fertilizer trade, long accustomed to making mixtures high in phosphate, was slow in seeing a place for this new combination. It was not until the spring of 1928 that the trade offered it to any extent.

An idea as to the growth in the use of nitrogen-potash topdressers can be obtained from the surveys conducted by the National Fertilizer Association in cooperation with the U. S. Department of Agriculture in 1934 and 1939. According to the data obtained in 1934, no one grade of nitrogen-potash topdresser was used to the extent of 1,000 tons. Five years later, the survey showed that nearly 12,000 tons of 10-0-10 were reported used in 10 states, this analysis ranking sixty-first in tonnage for the country as a whole. Smaller amounts of other analyses such as 9-0-15, with less than 1,000 tons each, probably aggregated several thousand tons.

One of the principal reasons for using nitrogen-potash topdresser is to supply sufficient amounts of these nutrients in a way that is safer from the viewpoint of the farmer than applying all the nutrients at planting time. Another reason is to supplement rather poorly balanced fertilizers which may be used as a matter of habit but which do not supply enough of these plant foods for a full crop. Loss of nutrients due to leaching also is reduced by the use of topdressers.

These factors are of importance in the growing of such crops as cotton, which may be easily injured if large amounts of fertilizer high in nitrogen and potash are applied by ordinary means at planting time in a dry season. Extra potash as a topdresser was naturally thought of by cotton farmers who had been using nitrogen fertilizers in this way, but many of them did not want to go to the trouble of making two applications, or of mixing the materials before application.

With the introduction of nitrogen-potash topdressers mixed by the fertilizer trade, it is now possible to apply both nitrogen and potash in one application. Another inducement to the use of these topdressers is the fact that they are usually very reasonably priced, due to economies the fertilizer manufacturer is able to effect in the mixing of such goods, and which ordinarily would not be possible

to the individual farmer. Sufficient nitrogen and potash thus can be applied at little or no extra outlay of money.

The large number of results from carefully controlled experimental work and from field work under practical conditions show conclusively that extra potash supplied as a topdresser is highly profitable on many crops in the South and probably in other sections of the country. This potash may be supplied by applying 50, 100, or 200 pounds of muriate of potash per acre. Since under many conditions extra nitrogen also is needed, the logical procedure is to apply the two together in the form of nitrogen-potash topdressers. The use of 200 to 400 pounds per acre of such analyses as 10-0-10, 9-0-25, 9-0-15, etc., at chopping time on cotton, as a topdressing in the spring on fall-sown grains, on corn a month or six weeks after planting, and on vegetable crops when they are up and well established or when they are beginning their period of fastest growth can be recommended as a profitable and safe way of supplying enough of these nutrients to make good yields of quality crops.

It is logical to assume that as research work goes on, and particularly as the results of the whole new field of experimentation on fertilizer placement begin to take shape, more and more use of topdressers will be recommended. One can see in such a development an easing up of the rush of spring work for growers, a more efficient use of nutrients by the plants, a lengthening of the season for the fertilizer trade. All would be welcome.

Fulfills Its Promise

When announcement of the forthcoming publication of the book "Hunger Signs in Crops" was made a few months ago, there undoubtedly was the hope among others, as there was with us, that the book would prove a real guide to the maze of plant-food deficiency symptoms which have come to light during comparatively recent years. The hope has been fulfilled. As one interested in birds would take a bird-guide book on a pleasure hike, "Hunger Signs in Crops" tempts one to start afield in search of plants to compare with the beautifully produced color pictures and other illustrations and add to his knowledge of the mysteries of the soil.

To agriculturists working in advisory capacities, the book must surely prove a valuable aid. Numerous Experiment Station bulletins have contained limited material on certain crops and certain deficiencies, but nowhere in one conveniently sized volume have so many crops and so many deficiencies been discussed and depicted. To the grower, it is a dictionary of plant needs and a key to successful farming.

Gove Hambidge, who edited the book, emphasizes that apart from its immediate practical value, the contents mark one more step in the study from the soil on up through man. What the soil does not have, plants will not get, and animals and men will lack also. The welfare of man is intimately bound up with the welfare of soils and plants because all of our food comes in the first instance from plants; even our meat, milk, eggs, and fish are simply plant substances rebuilt into other forms.

The book brings a further realization of these principles and a greater appreciation for the arduous years of research work which brought such information to light. We congratulate the American Society of Agronomy and the National Fertilizer Association, who are the publishers of the book, for gathering this information and presenting it to the public in such concise and attractive form.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Mimeo-Leaflet 47 of the University of Idaho, "Alfalfa Yellows," presents the findings of several years of research on the cause and control of the type of yellowing affecting many alfalfa fields in the State. Work in northern Idaho, and also of many investigators elsewhere, has shown that yellows will occur in soils which do not have sufficient available boron for plant needs.

The authors, G. O. Baker, W. E. Colwell, and J. M. Raeder, recommend the following control for alfalfa yellows:

1. Apply 40 pounds of agricultural granular borax per acre. Under no conditions should larger amounts be used.
2. Best results have been obtained with fall applications after the alfalfa has become dormant but before the ground freezes. Spring applications may be made, but the data obtained so far indicate results are not as satisfactory.
3. The borax should be spread uniformly.
4. The application rate should not exceed 30 pounds of borax if the alfalfa is to be plowed up before producing at least two crops.
5. Re-applications should not be made oftener than every three years.

Users are cautioned not to apply more or make more frequent applications than are recommended. Large amounts or too frequent applications are dangerous since borax in large quantities is toxic to plant growth.

¶ Of particular interest to many farmers in the State of Washington who are engaged in the production of intensive crops is Dr. L. C. Wheeting's informative publication, "Cooperative Field Experiments with Commercial Fertilizer Mixtures," Agricultural Experiment Station Bulletin 392. The results of a five-year study of fertilizer applications in different ratios to a variety of soils in Washington are reported for oat hay, mixed hay, alfalfa hay, grass-legume pastures, oats for grain, wheat, potatoes, corn for silage, sugar beets, and canning peas. The author has prepared a convenient chart based on these data, which shows the fertilizer requirements in terms of available nitrogen, phosphoric acid, and potash per acre of the crops mentioned when grown on different soils of the State. This information is given in accordance with previous cropping and the use of farmyard manure on the preceding crop.

Common ratios often giving good results are 1-2-1, 1-2-2 and 1-1-1. In these studies smaller applications than 20 pounds of available nitrogen, 40 pounds of available phosphoric acid, and 40 pounds of available potash per acre were not effective in giving increased yields when these elements were deficient in the soil. As might be expected, it is difficult to obtain economic returns with low-priced crops, but with crops such as potatoes, canning peas, and sugar beets, satisfactory profits from the use of fertilizers are possible.

According to Dr. Wheeting, there is no difficulty in obtaining in the State mixed fertilizers such as the 3-10-7, 3-10-10, 5-10-5, 5-10-10, and 5-6-8 analyses. In most cases, it is possible to purchase the mixtures that approximately meet the requirements denoted

in the chart for the various crops. Small variations of 10 pounds one way or another are said to be unimportant.

"The Effect of Nitrogen and Phosphorus on the Growth of Apple and Peach Trees in Sand Culture," Agr. Exp. Sta., Lexington, Ky., Bul. 410, Dec. 1940, C. S. Waltman.

"Effects of Mineral-nutrient Deficiencies and Excesses upon the Vegetative Growth and Flowering of Sweet Peas," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 745, Dec. 1940, Kenneth Post.

"Fertilizer Placement Under Irrigation in Washington," Agr. Exp. Sta., Pullman, Wash., Rep. from Jnl. Amer. Soc. Agron., Vol. 33, No. 2, Feb. 1941, C. Emil Nelson and L. C. Wheeting.

Soils

¶ "Soil Reaction (pH) Preferences of Plants," Special Bulletin 306 of the Michigan Agricultural Experiment Station, by C. H. Spurway, contains a listing of plants with their soil acidity or alkalinity preferences, compiled in comprehensive form for immediate reference. The pH values given are considered to be the best information on the subject available to date. Because of the many important factors of plant growth acting in conjunction with pH, this value must not be considered the only soil condition needing adjustment for any particular soil or crop. The soil reaction is a major factor in good soil management, but the other vital factors of plant growth cannot be neglected. Favorable soil conditions for any crop demand a suitable soil texture, the right temperature, and an adequate plant nutrient and water supply.

Hundreds of plants, their common name and botanical or scientific name for a more accurate designation of the plant, are listed in this worthy compilation. The optimum pH range given in the list is considered to be the most favorable for growth provided that the other soil conditions are met. In many cases the minimum and/or maximum pH limits are also given.

Professor Spurway is to be complimented. The bulletin places important information on soil reaction preferences of plants in the hands of growers in ready reference form.

"Why Is Subsoil Unproductive?," Agr. Exp. Sta., Fort Collins, Colo., Bul. 464, Feb. 1941, Robert Gardner.

"Save the Soil with Contour Farming and Terracing," Agr. Ext. Serv., Urbana, Ill., Cir. 513, Apr. 1941, E. W. Lehmann and R. C. Hay.

"Montana Soil and Moisture Conservation Practices," Agr. Exp. Sta., Bozeman, Mont., Mimeo. Cir. 27, Nov. 1940, Philip T. Allen.

"Analyses of United States Soils," N. J. Agr. Exp. Sta., New Brunswick, N. J., June 1940, J. G. Lipman, J. S. Joffe, and Adrienne B. Conybeare.

"Anjou Pear Responses to Irrigation in a Clay Adobe Soil," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 374, July 1940, W. W. Aldrich, M. R. Lewis, R. A. Work, A. Lloyd Ryall, and F. C. Reimer.

"Soil Survey of Tarlac Province, Philippines," Dept. of Agr. and Comm., Manila, P. I., Soil Rpt. 6, 1940, M. M. Alicante, D. Z. Rosell, R. T. Marfori, and S. Hernandez.

"Nature of Organic Matter in Western Washington Prairie Soils as Influenced by Differences in Rainfall," Agr. Exp. Sta., Pullman, Wash., Rep. from Jnl. Amer. Soc. Agron., Vol. 33, No. 1, Jan. 1941, R. H. Fowler and L. C. Wheeting.

"Rock Weathering and Soil Profile Development in the Hawaiian Islands," U. S. D. A., Washington, D. C., Tech. Bul. 752, Feb. 1941, G. J. Hough, P. L. Gile, and Z. C. Foster.

Crops

¶ Professor C. E. Phillips, in Mimeo. Circular 3 of the Delaware Extension Service, "Delaware Pastures," writes, "A good pasture is one that will supply continuous grazing of palatable nutritious grass from very early in the spring until late in the fall. . . . Since the factors influencing grass production vary considerably from one section of the country to another, so will the pasture management practices necessary to obtain good pasture." Well-fertilized pastures in adjoining areas are said to carry as high as 1.5 cows per acre for the entire season. Some few pastures in Delaware, because of good fertilization and management practices, produce many times the feed that the average pasture produces. Many pastures in the State, according to Professor Phillips, are simply areas of indifferent grass and weeds.

In addition to lime in accordance with the soil requirement, the application of 300 to 500 pounds of 20 per cent

superphosphate or 0-14-6 fertilizer per acre is recommended every 2 or 3 years to improve permanent pastures. A portion of the pasture area might receive some nitrogen fertilizer not later than April 1 to provide earlier spring grazing. Where new pastures are to be established, 2-12-6 for the heavier soils and 2-8-10 for the sandy soils are advised. If the land has not been limed recently, 1,500 to 2,000 pounds of ground limestone per acre should be used, as well as manure, especially over thinner areas.

The many additional points of proper pasture management stressed in this circular include factors influencing seasonal production, providing for continuous grazing, and seeding mixtures appropriate for each of the four pasture districts outlined.

"Genetic Relations of Sparse Lint, Naked Seeds, and Some Other Characters in Upland Cotton," Agr. Exp. Sta., Fayetteville, Ark., Bul. 406, Jan. 1941, J. O. Ware.

"The Mesa Experiment Farm Helps Farmers Help Themselves," Agr. Exp. Sta., Tucson, Ariz., Bul. 171, Feb. 1941, R. S. Hawkins and D. C. Aepli.

"Celery in Alberta," Dept. of Ext., Univ. of Alberta, Edmonton, Alta., Bul. 35, Dec. 1940, J. S. Shoemaker.

"Functional Disorders of Apples," Dept. of Agr., Ottawa, Canada, Pub. 694, Tech. Bul. 28, May 1940, C. A. Eaves and H. Hill.

"Blue-cured Tobacco Growing in Ontario," Dept. of Agr., Ottawa, Canada, Pub. 715 Farmers' Bul. 101, Feb. 1941, E. A. Stinson and H. F. Murwin.

"War-time Production Series," Agr. Sup. Bd., Dept. of Agr., Ottawa, Canada, Sp. Pamphlets: 1—Flaxseed, 6—Soybeans, 8—Fibre Flax Production in Canada, 9—Sudan Grass, 15—Pasture Improvement for Cheaper Production, 21—Coarse Grain Crops for Eastern Canada, 22—Hybrid Corn, 23—Field Corn, 27—Farmyard Manure, 40—Potato Culture, 42—Tomato Culture, and 43—Certified Seed Potatoes.

"Progress Report of the Superintendent for the Years 1931-1936," Dom. Exp. Farm, Ste. Anne de la Pocatiere, Que., 1938.

"Home Vegetable Gardening," Agr. Ext. Serv., Newark, Del., Ext. Bul. 34, Mar. 1941, Pearl MacDonald, William H. Phillips, Claude E. Phillips, Kenneth J. Kadow, and Louis A. Stearns.

"Gather Health from your Own Garden," Agr. Ext. Serv., Gainesville, Fla., Cir. 53, Mar. 1941, J. Lee Smith.

"Corn Varieties and Hybrids and Corn Improvement," Agr. Exp. Sta., Gainesville, Fla., Bul. 355, Feb. 1941, Fred H. Hull, J. D. Warner, and W. A. Carver.

"Dahlia Variety Test—1940," Agr. Exp. Sta., Experiment, Ga., Cir. 124, Dec. 1940, H. L. Cochran, David D. Long, Norman La Motte, and Theo. L. Bissell.

"Hawaii Agricultural Experiment Station Report, 1940," Agr. Exp. Sta., Honolulu, T. H., 1941.

"Annual Report of Iowa Agricultural and Home Economics Extension Service, 1939," Agr. Ext. Serv., Ames, Iowa.

"1940 Iowa Corn Yield Test," Agr. Exp. Sta., Ames, Iowa, Bul. P19, Feb. 1941, Marcus S. Zuber and Joe L. Robinson.

"Report on Agricultural Research for the Year Ending June 30, 1940. Part 1. Project Reports, Publications, Staff, and Financial Statement. Part II. Iowa Corn Research Institute, Fifth Annual Report," Agr. Exp. Sta., Ames, Iowa.

"Tenth Biennial Report of the Directors, 1938-1940," Agr. Exp. Sta., Manhattan, Kans.

"Strawberry Growing in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 203, Jan. 1941, R. J. Barnett.

"Kansas Corn Tests, 1940," Agr. Exp. Sta., Manhattan, Kans., Bul. 292, Jan. 1941, R. W. Jugenheimer, A. L. Clapp, and H. D. Hollembeak.

"Fifty-third Annual Report of the University of Maryland Agricultural Experiment Station," Agr. Exp. Sta., College Park, Md., Vol. 53, 1939-1940.

"Ornamental Trees," Agr. Ext. Serv., East Lansing, Mich., Ext. Bul. 160, (First Revision), May 1941, Charles W. Barr.

"Oats in Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 348, Sep. 1940, Roy Kuykendall, John Pitner, J. F. O'Kelly, J. L. Anthony, and C. Dale Hoover.

"Dry-land Pasture Experiments at the Judith Basin Branch Station, Moccasin, Mont.," Bul. 388, Mar. 1941, Ralph M. Williams and A. H. Post.

"Nebraska Pasture, Seeding and Management," Agr. Exp. Sta., Lincoln, Nebr., Cir. 67, Feb. 1941, A. L. Frolik and E. F. Frolik.

"Fruits and Nuts for Home Use," Agr. Ext. Serv., State College Station, Raleigh, N. C., Ext. Cir. 210 (Rev.), Jan. 1941, H. R. Niswonger.

"Lettuce Growing in North Carolina," Agr. Ext. Serv., State College Station, Raleigh, N. C., Ext. Cir. 248, Feb. 1941, Robert Schmidt.

"High-bush Blueberry Culture in Rhode Island," Agr. Exp. Sta., Kingston, R. I., Misc. Pub. 8, Dec. 1940, A. E. Stene.

"Fifty-third Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for the Year Ended June 30, 1940," Agr. Exp. Sta., Clemson, S. C., Dec. 1940.

"Uton—A New High-yielding White Oat Resistant to Loose and Covered Smuts," Agr.

Exp. Sta., Logan, Utah, Bul. 296, Apr. 1941, D. C. Tingey, R. W. Woodward, and T. R. Stanton.

"Extension Work in Agriculture and Home Economics, Annual Report, December 1, 1938 to November 30, 1939," Agr. Ext. Serv., Blacksburg, Va., Bul. 148, June 1940.

"Fiftieth Annual Report—For the Fiscal Year Ended June 30, 1940," Agr. Exp. Sta., Pullman, Wash., Bul. 394, Dec. 1940.

"Report of Agricultural Research and Other Activities of the Western Washington Experiment Station for the Fiscal Year Ended March 31, 1940," Western Wash. Exp. Sta., Puyallup, Wash., Dec. 1940, J. W. Kalkus.

"Supplementary Pastures and Hays," Agr. Ext. Serv., Madison, Wis., Cir. 315, Feb. 1941, H. L. Ahlgren, G. M. Briggs, and L. F. Graber.

"Practical Results from the State Experiment Farms," Agr. Exp. Sta., Laramie, Wyo., Bul. 243, Jan. 1941, W. L. Quayle.

"Fiftieth Annual Report of the University of Wyoming Agricultural Experiment Station, 1939-1940," Agr. Exp. Sta., Laramie, Wyo.

"Ramie Fiber Production," U. S. D. A., Washington, D. C., Cir. 585, Dec. 1940, Brittain B. Robinson.

"The Imperial Strains of Lettuce," U. S. D. A., Washington, D. C., Cir. 596, Feb. 1941, I. C. Jagger, Thomas W. Whitaker, J. J. Uselman, and Walter M. Owen.

"Culture of Orchids," U. S. D. A., Washington, D. C., Leaf. 206, David Lumsden and Furman Lloyd Mulford.

"Strawberry Culture, South Atlantic and Gulf Coast Regions," U. S. D. A., Washington, D. C., Farmers' Bul. 1026, Rev. Dec. 1940, George M. Darrow.

"Feeding Dairy Cows," U. S. D. A., Washington, D. C., Farmers' Bul. 1626, Rev. Nov. 1940, T. E. Woodward.

"Yield, Chemical Composition, and Feeding Value for Milk Production of Alfalfa Hay Cut at Three Stages of Maturity," U. S. D. A., Washington, D. C., Tech. Bul. 739, Oct. 1940, J. R. Dawson, D. V. Kopland, and R. R. Graves.

"Residual Effects of Forcing and Hardening of Tomato, Cabbage, and Cauliflower Plants," U. S. D. A., Washington, D. C., Tech. Bul. 760, Dec. 1940, M. F. Babb.

Economics

¶There has perhaps been no time in history when data relative to the consumption of farm products were of more concern to the Nation than at present. With the world confronted with the most destructive war in history, and agricultural nations struggling with problems involving supplies against demands, various data relative to the per capita changes in consumption of the leading farm commodities are of great value.

The Bureau of Agricultural Economics, U. S. Department of Agriculture, has recently published a report entitled "Consumption of Agricultural Products." According to this report, per capita consumption of food in the United States during the past 30 years has remained fairly stable, with but 2 significant exceptions—the recession occurring during the first World War and the depression beginning in 1929. This does not mean, however, that the consumption of all farm products has exhibited the same trend. There have been some important shifts, as for example, between beef and pork, butter and other fats, and fresh fruit and canned and dried fruit. But the net effect of these shifts on the total has been comparatively insignificant.

The year 1934 brought to an end the decline in per capita consumption of foods in the United States and a general increase in food consumption got underway. This continued to 1940 and may continue through 1941 because of the abundance of supplies and the increase in consumer income. Although there has been a considerable change in the composition of our population, it appears to have had little effect on total per capita consumption of food, but there have been striking changes in the per capita consumption of many of our food items. For example, we eat less wheat and other cereals per capita, fewer potatoes and apples, less beef and veal, and drink less tea than we did in 1909. We consume more vegetables, fruit, sugar, poultry and eggs, fluid milk, manufactured dairy products, edible fats and oils (other than lard and butter), cocoa and chocolate, and we drink more coffee.

It is not clear just what has brought about these changes in the individual items. Some changes have occurred in population, and ratio of city to rural population has increased. Some shifts have taken place because of a greater

variety of foods than was available 30 years ago. It is noted that the decline in the consumption of apples probably was the result of the development of the large-scale production of many other fruits. The development of more efficient methods of transportation and refrigeration has no doubt had a great influence on the rise in consumption of fresh fruits and vegetables. Changes in mode of living probably have affected consumption.

In the non-food items tobacco consumption has increased about 17 per cent during the last 30 years. During the first World War there was an artificially high wartime consumption, followed by a decline in the early '20's and then an upward trend when economic conditions began to improve. The increase in per capita consumption of cigarettes is about fifteen-fold, which might indicate that tobacco consumption has increased more than it actually has. This unusual rise in cigarette consumption has been offset to a considerable extent by the drop in the use of chewing tobacco, and cigars, and a slight drop in smoking tobacco and snuff.

The per capita consumption of rubber has shown a spectacular increase. Cotton has fluctuated widely during the period, beginning and ending with about the same per capita consumption. Other fibers including manila fiber, hemp, jute, sisal, and henequen have shown a decline in total and per capita consumption since 1909. Non-edible fats increased.

¶The Department of Agronomy of the University of Illinois recently issued a statistical report entitled "Fertilizers Sold in Illinois in 1940." During that year 8 new analyses were added and 11 of those sold in 1939 dropped, resulting in a total of 63 analyses in 1940 compared to 66 in 1939 and 73 in 1938. Most of the tonnage was included in the leading analyses, with 97.8 per cent of the total tonnage included in the first half of the different analyses sold. Over 91 per cent of the total tonnage of mixed fertilizers sold contained 20 units or more of plant food. In 1940 the 10 leading analyses were the same as those in 1939. The average plant-food content of the 10 leading grades has changed only slightly in the past 5 years. In 1936, for example, the average was 1.9 N, 11.6 P_2O_5, and 9.2 K_2O; whereas in 1940 it was 1.8 N, 11.6 P_2O_5, and 9.7 K_2O.

The leading grade sold in the State was 2-12-6, representing 30 per cent of the total tonnage. The 0-12-12 was second with about 12 per cent, and 3-12-12 was third with about 9 per cent, followed by 2-8-16 with 7 per cent. The total sales of mixed goods and materials amounted to 49,753 tons, of which 34,992 tons were sold in the spring and 14,761 tons in the fall. In addition to the above, there were 47,823 tons of rock phosphate sold in Illinois in 1940.

¶Fertilizer sales in Ohio in 1940 amounted to 363,320 tons, according to "Spring and Fall Fertilizer Sales in Ohio—1940," compiled by the Department of Agronomy, Ohio State University. Spring and fall sales were divided about equally with 192,316 tons in the spring and 171,004 tons in the fall. The 2-12-6 was by far the leading analysis sold, constituting 205,107 tons. The next most popular grade was 0-14-6 with 22,885 tons, followed by 2-12-2, 0-12-12, 3-18-9, and 4-24-12. In the materials list, 0-20-0 was the most popular material, representing 21,265 tons. Total sales of phosphate materials amounted to 27,361 tons, ammoniates 9,050 tons, and potash salts 613 tons.

The report has a very interesting table showing the total sales of fertilizers and their plant-food content for each year since 1928. In that year sales amounted to 320,866 tons, containing 3,941 tons of N, 42,756 tons of P_2O_5, and 10,597 tons of K_2O. The depression low point was in 1932 when 169,239 tons were sold, containing 3,342 tons of N, 22,926 tons of P_2O_5, and 5,959 tons of K_2O. The year 1940 was the peak for fertilizer sales in Ohio with a tonnage of 363,320, containing

8,506 tons of N, 47,224 tons of P_2O_5, and 22,045 tons of K_2O.

"Dairy Management in California," Agr. Exp. Sta., Berkeley, Calif., Bul. 640, Aug. 1940, Arthur Shultis.

"Graphic Summary of Farm Tenancy in Georgia," Agr. Exp. Sta., Experiment, Ga., Bul. 210, Mar. 1941, J. C. Elrod.

"Five-year Summary of Fruit and Vegetable Unloads in Honolulu, 1936-1940," Agr. Ext. Serv., Honolulu, T. H., Cir. 109, Mar. 1941, Kenneth I. Hanson and Kenichi Murata.

"Index Numbers of Prices and Production of Farm Products in Kentucky," Agr. Exp. Sta., Lexington, Ky., Bul. 411, Jan. 1941, Dana G. Card, A. J. Brown, and O. M. Farrington.

"Crop Report for Michigan—Annual Crop Summary 1940 and Crop Statistics 1930-1940," Dept. of Agr., Lansing, Mich., Jan. 1941.

"Land and Fiscal Problems in Reynolds County, Missouri," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 324, Dec. 1940, Ross J. Silkett.

"Land Ownership and Tenure, Huntley Irrigation Project—An Analysis of Their Evolutions and Implications," Agr. Exp. Sta., Bozeman, Mont., Bul. 385, Jan. 1941, P. L. Slagsvold.

"Commercial Fertilizer Report for 1940," Agr. Exp. Sta., Bozeman, Mont, Bul. 387, Feb. 1941, John T. Kelly and A. R. Patton.

"Inspection of Commercial Fertilizers for 1940," Agr. Exp. Sta., Durham, N. H., Bul. 329, Nov. 1940, T. O. Smith and H. A. Davis.

"Agronomic Farm Practices in Franklin County, North Carolina," Agr. Exp. Sta., State College Station, Raleigh, N. C., Tech. Bul. 66, Sept. 1940, J. F. Lutz and C. B. Williams.

"The Effect of an Unstable Price Level on Farming," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 447, Nov. 1940, G. E. Brandow.

"Land Use and Production Costs on Dry-land Wheat Farms, Columbia Basin, Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 373, June 1940, A. S. Burrier and W. W. Gorton.

"Some Economic Considerations of Marketing Oregon Fruits and Vegetables Through Cooperative Canning Associations," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 377, Oct. 1940, Daniel B. DeLoach and Charles W. Peters.

"Some Economic Considerations Affecting the Marketing of Oregon Dried Prunes Through Cooperative Dried-prune-packing Associations," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 378, Nov. 1940, Daniel B. DeLoach and Charles W. Peters.

"Ranch Organization and Range Land Use in Coos and Curry Counties, Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 381, Dec. 1940, Harold R. Hochmuth and William W. Gorton.

"Production and Marketing of Dry Peas in the Palouse Area," Agr. Exp. Sta., Pullman, Wash., Bul. 391, Dec. 1940, Woodrow W. Rufener.

"Economic Conditions and Problems of Agriculture in the Yakima Valley, Washington —The Yakima-Tieton Irrigation District," Agr. Exp. Sta., Pullman, Wash., Bul. 393, Dec. 1940, Edgar B. Hurd and Harold F. Hollands.

"Agricultural Adjustment, 1939-1940. A Report of the Activities of the Agricultural Adjustment Administration July 1, 1939, Through June 30, 1940," U. S. D. A., Washington, D. C., G-104, Nov. 1940.

"Handbook 1941 Agricultural Conservation Program," U. S. D. A., Washington, D. C., SRB-501, Arkansas B Area.

"Handbook 1941 Range Conservation Program," U. S. D. A., Washington, D. C., SRB-551, Texas and Oklahoma.

"Wheat Marketing Quotas," U. S. D. A., Washington, D. C., Apr. 1941.

"Agriculture and the Americas," U. S. D. A., Washington, D. C., G-105.

"Report of the Administrative Official in Charge of Surplus Removal and Marketing Agreement Programs, 1940," U. S. D. A., Washington, D. C.

"1941 Agricultural Outlook Charts, Fruits and Vegetables," U. S. D. A., Washington, D. C., Oct. 1940.

"Price Spreads Between the Farmer and the Consumer," U. S. D. A., Washington, D. C., Sup. to Rpt. of July 1936, Feb. 1941, Richard O. Been and Frederick V. Waugh.

"Publications Dealing with Farm Management: 1903-June 30, 1940," U. S. D. A., Washington, D. C., Dec. 1940, M. A. Crosby, M. R. Cooper, and Della E. Merrick.

"Agriculture's Requirements for Transportation in 1941," U. S. D. A., Washington, D. C., Mar. 1941, E. Orth Malott and William E. F. Conrad.

The head of the house entered the room. "Now, young man," he said sternly to his daughter's suitor, "all lights are turned out in this house at eleven prompt."

"Suits me, sir," replied the young man, blithely. "As a matter of fact, I was just going to turn this one out when you came in."

"Shine, please, boy!" said the six-foot-five soldier to the shoeblack.

The boy looked down at the vast expanse of boots before him and shook his head questioningly. Then a determined look covered his face.

"Bert," he called out to another boy, "Gimme a hand! I've got an army contract!"

Foreign and International Agriculture

To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

Die Ernährung der Pflanze, Vol. 36, No. 8, August 1940

THE FORMATION AND TRANSFORMATION OF SOILS IN THE MOIST TROPICS. *By H. Kuron, Soil Science Institute, Berlin, Germany.*

The author discusses in some detail the various factors that determine the kind of soil produced in a given location. It is stated that the process by which rock is transformed into soil consists essentially of only a few subprocesses, regardless of the highly variable conditions existing in various parts of the world. The first of these is the decomposition of the labile aluminosilicates in the stones. The second subprocess is the addition of organic matter of one kind or another to the decomposed rock material. The third process determining the character of the soil is the rearrangement of the component soil materials under the influence of various outside forces prevailing in the locality. The time during which these processes act is also an important factor in determining the character of the soil.

INVESTIGATIONS ON THE AMINO ACID CONTENT AND THE SUSCEPTIBILITY OF POTATOES TO VINE AND TUBER ROT (PHYTOPHTHORA INFESTANS DE BY). *By F. Alten and H. Orth, Lichterfelde Agricultural Experiment Station, Berlin, Germany.*

Experiments and practical experience had shown that potatoes lacking potash were especially susceptible to infection by Phytophthora infestans. The action of the potash appeared to be somewhat indirect, in part at least, since nitrogen relationships in the plant seemed to be a factor in the development of the organism, which used the nitrogen compounds in the plant as its source of this nutrient. The authors analyzed variously fertilized potatoes in order to obtain further information on these relationships. The tubers were inoculated with the organism and grown with no fertilizer treatment, a nitrogen and phosphorus fertilization, and with three rates of potash fertilization in addition to nitrogen and phosphorus. Three series with such treatments were grown, one with manure in addition to the mineral fertilization, another with lupine green manure and fertilizers, and the third with only the fertilizers. The tubers showed greater rotting due to the organism when potash was omitted from the treatment. The differences were greater when no manure or green manure was used.

After harvest, the tubers were analyzed for total nitrogen, non-protein nitrogen, protein nitrogen, and alpha amino acid nitrogen. As the potash fertilization was increased, the non-protein and amino acid nitrogen decreased, and infestation with the Phytophthora organism likewise decreased. The higher potash fertilization, by decreasing the easily decomposable amino acid nitrogen, reduced the nitrogen available to the organism and limited its development.

Plants grown in nutrient solutions showed the same relationship of potash fertilization to form of nitrogen present in the leaf as in the tuber. With very high nitrogen fertilization, however, it was not possible to reduce the nitrogen compounds in the leaf. The relationship of potash fertilization to nitrogen

compounds in the tuber, and susceptibility to the organism was found to hold with several varieties of potatoes.

THE ACTION OF SOME COMPLETE FERTILIZERS ON ANNUAL FLOWERS. *By Dr. Vogel, Weihenstephan, Germany.*

While the soil is of great importance in the growing of flowers and ornamentals, the use of fertilizers to improve its fertility is finding increased acceptance among growers. To obtain further information on the response of plants to fertilizers, four ornamentals were grown with five different fertilizers. The plants were aster, zinnia, snapdragon, and salvia. The fertilizers were Albert's Flower Fertilizer, amsupka, nitrophoska, new hakaphos and old hakaphos. The plants were grown in pots. New hakaphos and nitrophoska produced the best general plant development and flower. The fertilizers not doing so well in some cases seemed to have too high a salt content, in some cases too little phosphoric acid, and in others too little potash.

Soils and Soil Management

(*A Book Review*)

A NEW addition to the literature on soils is A. F. Gustafson's book, "Soils and Soil Management" (McGraw-Hill Book Company, New York, N. Y., 1941. $3.00). This volume covers the whole field of the subject indicated by its title, including the formation and properties of soils and their management and fertilization.

Following the introduction, in which the fundamental importance of soils to our very existence is brought out, the first chapter tells how soils are formed and gives the various agencies instrumental in producing different kinds of soil. A typical soil profile is described, using the modern nomenclature. The second chapter discusses the physical properties of soils under sections devoted to particle size and characteristics, weight of soils, and soil temperature and factors influencing it. The next chapter is devoted to soil organisms with most attention paid to the microorganisms. Chapter four deals with organic matter and factors influencing its gain and loss.

Soil moisture takes up the next two chapters. The form, movement, amounts of water and its influence on certain soil properties, the use of water by plants, gain and loss of water by the soil, drainage, irrigation, and dry-land farming are covered. The seventh chapter is devoted to tillage in its various aspects, with several types of equipment described and illustrated. The following two chapters treat in some detail soil erosion and its control, utilizing to advantage the latest work being done on this important phase of soil management. Soil acidity and its control by liming is the subject of the tenth chapter. In this the significance of the pH scale of acidity, methods of determining the acidity of soils, and the use of different kinds of lime are discussed. The following chapter deals with alkali soils, and tells how they can be handled for crop production.

Most of the remaining chapters are devoted to the various aspects of soil fertility. Chapter 12 considers the nitrogen relationship in the soil. The next chapter covers the importance and utilization of farm manure in relation to organic matter and the plant nutrients it furnishes, while chapter 13 rounds out the organic matter picture with a discussion of green manure and cover crops. The next two chapters deal with commercial fertilizers, giving brief descriptions of the composition, origin, and mode of production of most of the important nitrogen, phosphorus, and potassium fertilizer materials, the prin-

cipal functions of these nutrients, the mixing of fertilizers, and methods of application. The secondary and trace elements in fertilization are touched on. The rotation of crops takes up the seventeenth chapter and the following chapter brings together the teachings on soil fertility maintenance. The final chapter is devoted to peat and muck soils, their origin, and management.

As will be observed from the contents of the book, it covers a broad field. With such a wide scope it was necessary to omit much detail. The result is a book of a rather general nature. Numerous references given through the text will enable the student or reader to obtain further information as desired.

The subject matter is presented in a clear manner so as to be easily understood. The practical aspects of soil management have been stressed over the purely scientific phases, although fundamentals rather than mere rules of thumb are given. The author has called on his extensive experience as teacher and writer to prepare a book well adapted to the needs of a general course in soils or as a general reference.

Some Early Experiences With Fertilizer

(*From page* 14)

any slow acting form of nitrogen should be avoided, or used very sparingly.

Contrary to the effect of organic nitrogen, applications of potash seemed to have a most beneficial effect in building up an immunity in apple trees against attacks of this disease. On examining apple orchards where this disease was prevalent, a few trees would be found growing near the houses that were practically free, if not altogether free, from this trouble. On inquiry I invariably was told that the wood ashes from the houses were scattered around the nearby trees.

In the City of Vancouver, I examined several apple trees growing in a residential plot which, from the numerous scars visible but healing over, showed evidence of having suffered severely from this anthracnose a number of years before; one tree particularly so. At the same time it was evident that there had been no recurrence of this trouble for several years. My curiosity being aroused, I asked the owner for an explanation. He told me that some years ago all of his trees were in a bad way from this disease, particularly the one I had observed as having been so much worse than the others. At that time he had considered this one hopeless and thought it would have to be dug out, but as luck would have it he obtained some potassium nitrate, a 13-0-42, and began using it as a fertilizer. The disease apparently was checked the first year the application was made and there had been no recurrence since. He could not attribute the recovery that had taken place to anything but the potassium nitrate used, as no other fertilizer had been applied, and the trees had not been sprayed. Outside of the fertilization the trees had received no change in care.

The above example so strongly indicated the value of potash in building up a resistance to this disease that further proof seemed to be well worth seeking. On examining other apple orchards, where potash had been applied for the first time, evidence was found indicating that this disease was already showing distinct signs of being checked. However, it was also noticeable that where heavy applications of stable manure or fish had been made they seemed to offset the beneficial effect of the potash.

I was soon able to obtain further and convincing proof of the efficacy of potash in controlling this disease. My work took me across the line into the

State of Washington, and I learned that their Horticultural Commissioner, Mr. Van Volkenberg, in carrying out tests with potash and lime to determine their effect in controlling this apple tree anthracnose, had met with marked success. He had also issued a bulletin covering his work. Unfortunately, although I endeavored, I failed to meet him and get information regarding his findings at first hand. Better luck awaited me in the town of Puyallup where I met Mr. Paulhamus, then president of the Puyallup Berry Growers Association. He told me that his two apple orchards which were in a bad way from this disease had been completely cured by Mr. Van Volkenberg through the use of potash and lime as a fertilizer. Mr. Van Volkenberg also condemned the use of organic manures in apple orchards, as nitrogen in such forms certainly aggravated this trouble by creating a condition in the trees favorable to its attacks.

In British Columbia up to this time no tests had been made with lime to determine its value in controlling this disease in apple trees. Potash used alone seemed to be all that was necessary. At the same time the good effect noted from wood ashes would indicate that lime, too, might be of value.

When I left British Columbia to take up my work in California again, the value of potash in building up immunity in apple trees against this bark canker was so well established it seemed that this information must spread and be applied widely, but unfortunately such was not the case. Fully 20 years later I had occasion to again visit the State of Washington and the Province of British Columbia, but with the exception of Mr. Paulhamus, who was still president of the Puyallup Berry Growers Association, I could find no one who seemed to have any knowledge of the work accomplished by the use of potash in combatting this apple tree anthracnose. Mr. Paulhamus not only corroborated the statements he had made 20 years before, but was still firmly convinced that potash used as a fertilizer did create an immunity in apple trees against the ravages of this bark canker. Furthermore, he was so impressed with the value and need for potash in the growing of other fruits that he was strongly advising berry growers in his organization to use a complete fertilizer containing 10% potash on their berry crops.

Soil Productivity in the Southeast

(*From page* 22)

are blessed with one of the most favorable agricultural climates in the world. Why should a land with such an abundant spring and early summer rainfall be faced with the insufficiency of soil moisture to the extent that the Southeast is? The answer has already been given. Our sandy Coastal Plain soils and clayey Piedmont soils have such low water-holding capacities that almost every season inestimable damage is wrought by lack of sufficient soil moisture. For a crop with a relatively high water requirement, such as corn, only our lower lying areas with sufficient organic matter to afford water-holding ability are suited to supply the necessary water throughout the average growing season.

In addition to low water intake, low water-holding capacity, poor aeration, and lack of adequate energy and active calcium and magnesium to support the necessary biological processes, many of our Piedmont Plateau soils possess undesirable physical characteristics, even to such an extent as to somewhat limit proper root development, especially at depths of 7 to 12 inches where the soil may be so impervious as to limit root extension both as a physical barrier and by affording insufficient aeration to support respiration in the cells of the growing root tips. Thus, we do not

have to extend our consideration of cultivated soils very far, especially in conjunction with practical agricultural knowledge, to clearly realize the immense importance of factors other than those directly concerned with nutrient supply.

The fertilizer industry has done much toward solving problems and furnishing valuable information relative to the supply, availability, and application of plant nutrients. In addition, the state experiment station workers have devoted major attention to these and related factors. Naturally, we are more advanced as a whole along these lines today than we are along certain other fundamental lines, such as those referred to above.

It is obvious to most agricultural workers in the South that under the conditions of the average farmer the returns from commercial fertilizers, per dollar invested, are below what they should be, not so much because of the kind or quality of the fertilizers, but more because of the limitations placed upon the productivity of soils by these other factors. It is well known to most farmers that to produce a half-way respectable yield, some sort of fertilizer must be used. Though this may be but two or three hundred pounds per acre of a relatively low analysis, they know that it will pay them to use it. If twice as much were used, the return per dollar invested could well be twice as great, but if this quantity were again doubled, a corresponding return on the investment would certainly not be forthcoming under most farming conditions. An adequate response to heavy fertilization can not result mainly because of the limiting physical and biological factors, and not because of insufficient nitrogen, phosphorus, or potassium. If these limitations can somehow be removed, or at least remedied, then in all likelihood it will not be unreasonable to expect the average farmer to secure greater profits from his fertilizers, even beyond the levels of application in pounds per acre of nutrients which he now considers to be unreasonably heavy.

Despite current efforts to control agricultural production through controlling acreages planted to important crops, modern man has always, and always will, strive to produce larger and more economical yields per acre. His main desire is naturally to do this ever more economically. If he cannot produce even normal yields economically, then should not more effort be made to reach this goal than is being made? As has already been stated, the average yields of corn and small grains in the South can not be considered as normal in relation to the national average. This is all the more reason why we should become more desirous of putting our agriculture on a more prosperous basis.

A Program Needed

We should endeavor to devise and undertake some sort of a state-wide educational program of intensive character designed to enlighten our farmers regarding the nature and importance of some of the fundamental problems which place untold limitations upon them. It is true that since the advent of the Soil Conservation Service and the Tennessee Valley Authority, many farmers touched by these organizations have come a long way toward realizing the importance of legumes, lime, and superphosphate, and are without doubt better off today than previous to the advent of these advocated practices.

If we could in the near future undertake a campaign to reach the average farmer of the South, taking advantage of the experience gained by the above and by our state organizations, it is not unlikely that in six to eight years the South, as a whole, would begin to realize far reaching results. Under the present set-up it will be a much longer time before the "average" farmer is directly or perhaps indirectly benefited.

In this improved agriculture most farmers would have some appreciation of lime and magnesium, of fixation and availability of potash and phosphoric acid, of cover and green manure crops,

of organic matter, of biological activity, of water intake and water-holding capacity, of aeration in root development and biological activity, of the importance of minor elements, of the low nitrogen level maintained by nature in this climate, of rotations, of improved varieties, and diseases and insect control, as well as of methods and rates of applying fertilizers and of the use of adequately balanced and higher analysis fertilizers.

Garden Most Valuable Acre on the Farm

(*From page* 18)

each year. This plan will permit the rotation of the crops and avoid the repeated planting of any crop on the same space.

A third point in the soil-improvement program should be the application of moderate quantities of commercial fertilizers. From 300 to 500 pounds of a good grade complete fertilizer may be profitably applied to the average farm garden of one-half acre. This material may be broadcast just before the soil is disked, or it may be placed under the rows and thoroughly mixed with the soil before planting. Different crops vary greatly in their fertilizer requirement, but a complete mixture containing 3 to 5 per cent nitrogen, 8 to 10 per cent phosphoric acid, and 6 to 8 per cent potash will be satisfactory for general application, results from the College experimental garden showed.

Garden use of commercial fertilizers has taken a new trend in Tennessee in recent years. Not only is it now felt that generous use of commercial fertilizers will release manure for application elsewhere on farms, but that a surplus of fertilizer plant foods beyond what plants actually need for their own growth is by no means a loss. Phosphorus and lime, when in excess in animal foods, have produced added growth in animals, and it is supposed they may do the same for humans when present in garden vegetables. Potash, when in short supply in garden soil, may be supplemented from commercial sources with expectation that improved growth of many vegetables will bring better food values for farm families. Extension workers in Tennessee are calling attention not only to more food from the garden, but to food richer in the minerals needed for strong bodies.

Another conclusion drawn from the experimental garden is that crops should be arranged in such a way that the space will be used efficiently and yet so that the soil preparation, planting, and cultivation can be done most conveniently. To accomplish this the following group plantings, based on experimental garden results, are recommended:

1. Quick-maturing vegetables—planted in early spring: Lettuce, kohlrabi, cauliflower, peas, radishes, onions (green), spinach, mustard, turnip greens, etc.

2. Long-season crops—planted in early or mid-spring to remain during summer: Irish potatoes, cabbage, beets, parsnips, salsify, carrots, and onions (dry).

3. Crops tender to frost—planted in late spring or early summer: Corn, beans, sweet potatoes, tomatoes, cucumbers, peppers, lima beans, okra, peas (dry), eggplant, pumpkins, etc.

4. Fall crops—planted in late summer or early fall to mature during cool weather: Turnips, mustard, kale, Irish potatoes, and turnip greens.

5. Perennial crops—planted in spring to remain for several years: Asparagus, horseradish, rhubarb, onions (multiplier), parsley, etc.

With proper care the crops may be arranged in such a way that a considerable space can be prepared and planted at one time, and they will mature so that the area can be worked and another

crop planted in the same place. This practice is known as succession planting, and is very desirable in the garden if the soil is fertile, abundantly supplied with humus, and in good physical condition. It prevents the discarding of some parts of the garden after a crop has been harvested and weeds from producing seeds to give trouble in the future.

One of the most important factors in the production of any crop is good seed. Of course, good seed is no guarantee against failure if cultivation is neglected or if the weather is extremely unfavorable, but the use of poor seed makes success almost impossible under the best conditions. For the home garden the necessary plants, such as cabbage, tomato, pepper, eggplant, etc., can be economically produced in a hotbed. In this way they can be made available at the proper time and can be set into the garden with best chances of success.

There are numerous methods in common use which help to control insects and diseases in the garden. Many of these practices have only an indirect effect but they are of great importance. For example, fall-plowing exposes to the extreme winter weather many insects which have been harbored in the soil, and results in their destruction. An important rule in the avoiding of many plant diseases is crop rotation; that is, the same crops should not be planted year after year in the same place.

One of the most important methods of avoiding serious trouble from pests in the garden is the careful destruction of all refuse and the thorough cleaning up of fence rows, terraces, and any other cultivated land immediately around the garden. In this way insects, which are passing the winter in the trash on these neglected areas, will be destroyed, and trouble from such insects as the Mexican bean beetle, Colorado potato beetle, and harlequin cabbage bug will be greatly reduced.

The turning under of organic matter of all kinds, including the remains of crops, is frequently recommended for increasing the fertility and improving the mechanical condition of the soil. However, in the garden these crop remains may frequently carry diseases which will be a menace to future crops, and, therefore, it is a good rule to rake off and burn all of the crop remains in the garden. A very small quantity of manure or a good commercial fertilizer will do as much good as would these crop remains without the danger of carrying important diseases.

Indiana's Latest Tomato Champions

(*From page* 20)

by any Indiana grower) makes these boys champions.

Their tomatoes were grown in one corner of a 63-acre field. In 1939, this field was in clover, pastured by hogs; in 1938, in wheat; and in 1937, in corn. There were 6 loads of manure per acre spread on this field and after it was plowed April 1, two tons of lime were broadcast on it. Just before the plants were set, 500 pounds of 2-8-16 were applied per acre. Arkansas plants, grown from Indiana Canners Association Certified Seed, were set in rows 3′6″ x 3′6″.

The tomatoes were cultivated twice with a two-horse cultivator and once with a one-horse cultivator. It has been said there was never a chance for a weed to get started, for the boys were always in the patch with their hoes. They, with the help of one neighbor boy, did all the picking.

The accomplishments of these youngsters will make the "oldsters" step lively just to stay in the running.

Synthetic Wood Ashes Require Boron

(*From page 9*)

the main to their boron content. Several field and laboratory trials, the results of which are shown in Table 4, bear out this contention. Replicated field plots of alfalfa were established on a Colton sandy soil to which lime, superphosphate, potash, and boron were applied in order to make, as it were, synthetic wood ashes. Commercial Canadian hardwood ashes, sown at 2- and 4-ton rates, were compared with their chemical fertilizer equivalents of hydrated lime, 20% superphosphate, muriate and sulphate of potash (half and half), with and without borax (20 and 40 pounds per acre). The yields of alfalfa, measured in 1939 and 1940, are shown in Table 4 and Fig. 3.

TABLE 3—BORAX IN WOOD ASHES

Origin	Borax per ton*
	lb.
Ontario, Canada	10.0
Ontario, Canada	14.3
Stowe	15.0
White River Junction	15.7
Franklin	15.7
White River Junction	15.7
Newport	17.9
White River Junction	17.9
White River Junction	19.4
Canaan	20.1
Newport	20.8
Guildhall	22.2
Beecher Falls	25.8
Guildhall	25.8
Randolph	26.5
Guildhall	29.1

* All samples were dry and unleached.

Borax Increased Yield

The results show that without borax on this soil ordinary mineral fertilizers were ineffective for the production of alfalfa. In conjunction with borax, however, alfalfa yields doubled with practically all cuttings. Chemical fertilizer with borax was even superior to wood ashes. This is at present unexplainable unless it is due to a higher availability of the applied elements in the fertilizer. When 40 pounds of borax per acre were applied, the yield

TABLE 4—THE EFFECT OF HARDWOOD ASHES, AND THEIR CHEMICAL FERTILIZER EQUIVALENT WITH AND WITHOUT BORAX ON YIELDS OF ALFALFA

Treatment (per acre rate)	Yield per acre (dry wt.)			
	1939		1940	
	1st cut	2nd cut	1st cut	2nd cut
	lb.	lb.	lb.	lb.
Wood ashes—2 tons*	1,500	1,100	2,900	900
Fertilizer equivalent to 2 tons of ashes	1,300	500	1,700	400
Fertilizer equivalent and 20 lb. borax	2,400	1,400	3,500	1,300
Wood ashes—4 tons	2,600	1,600	3,600	1,400
Fertilizer equivalent to 4 tons of ashes	3,200	1,100	2,800	700
Fertilizer equivalent and 40 lb. borax	4,600	1,800	3,900	2,500

*The commercial Canadian hardwood ashes used contained 1.5% P_2O_5, 6% K_2O, 89% calcium carbonate equivalent, and 10 pounds per ton borax equivalent.

was much superior to that secured when less was used. With borax healthy stands were grown, of which any farmer would be proud, and they still remain dense and green. Furthermore, the borate-fertilized second crop, which was allowed to go to seed in 1940, produced more than 35 times as much seed as the unborated. This appears to be an outstanding, even though preliminary, finding.

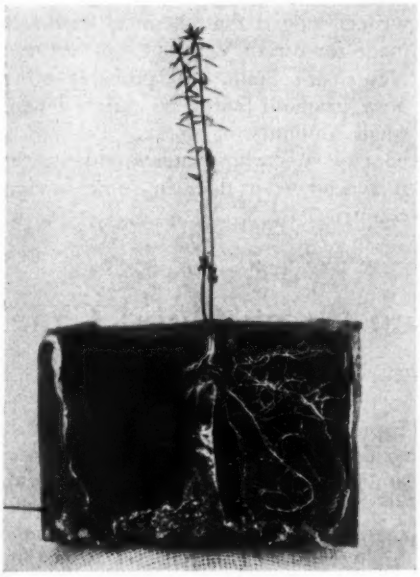


Fig. 4. An extreme case where boron is required—flax plants grown in a divided paraffin pot on an A_0 podzol soil. Both halves were slightly overlimed and abundantly fertilized with N, P, K. The right half received borax (50 pounds per acre); left half, no borax. Liming this organic soil to neutrality or slightly above causes it to fix large amounts of boron in a form unavailable to plants. In the high-fixing borate free media (left), roots failed to develop or even venture forth to obtain the other plant food present. The cause of borate fixation is more fully explained in Vermont Station Bulletin 460.

Most discouraging results were secured when borax was omitted from the fertilizer. The terminal leaves of the alfalfa plants were yellow and bronze colored, especially in dry weather; the plants blossomed defectively, failed to set seed, and even grew more sparse. These results are leading to further field trials in cooperation with farmers who wish to grow alfalfa seed but who have had innumerable failures.

Four more alfalfa field plots were established in the spring of 1940 to test borated and non-borated fertilizers (borax at 30 pounds per acre). Counts already indicate legumes to be one-third more dense where borax was added to the fertilizers. One of the plots is located on a clay soil where such favorable responses were not expected.

Boron is therefore an important crop-producing constituent of synthetic wood ashes, being in terms of alfalfa growth almost as essential as lime, phosphate, and potash. Its absence explains the failures from the use of these other three essentials. On this crop, which is

Fig. 5. A flax plant recovering from severe lime induced boron deficiency. When grown on a heavily limed podzol soil, it developed necrotic, yellow terminal buds, three short multiple branches, and a single stubby root (see main root in the center of the picture). After borax was applied to the aerial parts as a spray and to the roots as a solution, the plant was actually resurrected from the dead, producing an abundance of side roots and a normal shoot from one of the three branches.

recognized to have a high boron requirement, the need for borax in Vermont appears to be growing more acute. If it is not used, the stands will fail. In fact, its lack explains why many stands have failed shortly after seeding and why others have failed where once good stands existed. In supplying the abundance of lime which alfalfa requires, farmers unwittingly have induced and aggravated a serious boron deficiency on soils already low in boron, which then spells doom for all legumes they sow. (Figs. 4 and 5.)

Boron is known to be essential in Vermont apple orchards and may also be essential in the field for other lime-loving plants, such as red clover, field and garden beans, tomatoes, lettuce, beets, cabbage, and spinach (See Vt. Sta. Bul. 460). Borax may be effectively spread on the surface of the soil in granular form; but since there is much danger of burning the foliage if too heavy applications are made, farmers should consult their county agents before attempting to use it. The writers suggest that chemical fertilizers made for use in Vermont, northeastern New York State, and probably other New England States, be enriched with small amounts of borax. Perhaps a borated superphosphate would answer this need as it does in some foreign countries.

Florida's Everglades Can Grow Good Cane

(*From page* 11)

at the bottom bring approximately 117 pounds P_2O_5 into use each year, and this will continue so long as subsidence continues. This yearly supply of 117 pounds P_2O_5 would answer, provided it is all available, for a yearly crop of 78 tons mill cane.

Those who do not care to accept this reasoning may find solace in the explanation for large crops on peat soils deficient in phosphate offered by Hilgard, who recognizes such cases of excellent plant response on peat soils which are deficient in certain elements. His explanation fits conditions obtaining in the Everglades peat to a tee when he says, "Large quantities of organic matter offset low phosphoric acid, which is, on the other hand, rendered inefficient by much ferric oxide. Generally phosphoric acid less than .05 per cent indicates deficiency, unless much lime is present" (2).

As a matter of interest regarding ferric oxides, an average of 1,547 mainland mineral soils shows the presence of 33.4 tons per acre 6 inches (3). For our sawgrass peat, total ferric oxide is found to be 2.1 tons per acre 6 inches (3). From this one might judge that ferric oxide is present in such relatively low amounts as to interfere but little with efficiency of the phosphoric acid in our sawgrass peat, and at the same time the high organic content clearly offsets any phosphate deficiency in the matter of vegetative growth.

This new country began settlement about 1910, the first settlers penetrating inland by boat and taking land on a narrow ridge bordering Lake Okeechobee. This border, amounting to some 10,000 acres, is now classified as custard apple muck, a name taken from the trees originally found growing thereon. This peat is more plastic and of higher ash than is the sawgrass peat, and from the first, excellent crops of truck and cane were grown upon it. In fact, so luxuriant was the cane growth that observers, thinking peat is peat, arranged for a sugar house which was in shape for grinding the crop of 1924.

It so happened that a large portion of the land in the hands of the sugar company was sawgrass, the custard apple already planted would not begin to supply the mill during the season.

To expand then meant a large planting on sawgrass peat. These plantings came to poor stands, with surviving stools stunted as though seriously diseased. Crop prospects on such sawgrass peat appeared so discouraging that extension of the enterprise appeared ended. Extending on custard apple peat seemed out of the question, as the great bulk of it had been taken up by independent farmers who found the revenue from truck crops such that if purchasable at all, it would be at exorbitant prices.

About this time, a few truckers who had extended their plantings to the marginal sawgrass peat noted that truck crops improved through successive years, where bordeaux mixture had been used on previous crops. "In 1924 Director Wilmon Newell made a series of pot experiments using manure, garden soil, lime, gypsum, copper sulfate, superphosphate, potash, and other materials, testing them by the growth of Brabham cowpeas. In these trials best growth and vigor of the plants were secured following the application of copper sulfate, followed somewhat closely in the order named, by sulfate of potash, hardwood ashes, and manure" (5). These findings were later confirmed by field tests instituted and still preserved in original form, though replanted to superior cane varieties bred at this station since 1930.

Potash Effective

The effect upon cane of potash and copper applied to sawgrass peat soil is shown in the illustrations. These are of second stubble F 31-962, the one on peat receiving copper alone, the other adjoining in the same series showing the effect of potash with copper sulfate.

To be complete one should be able to show cane growth resulting from potash alone, which from experience is known to be even more restricted than from copper alone. After photographing, the cane was cut as for mill, the weight from copper alone indicating a yield of 13.3 tons per acre, while the copper and potash plots had a yield of 39.28 tons mill cane per acre. This is not yet the whole story.

Can there be any influence on juice quality attributable to the use of potash? Canes from the above plots were milled and the juices analyzed immediately; that from copper fertilization showing on a 78 mill extraction a 96 test sugar recovery of 183 pounds, that from copper and potash 215 pounds per ton, a difference of 32 pounds per ton in favor of the potash-copper treatment. In sugar per acre this stands at 1.2 tons from cane grown on land treated to copper only, and 4.17 tons when potash is used with copper.

In the above test, potash was applied at the rate of 300 pounds per acre. Commercial applications average around 200 pounds per acre. There seems to be ample evidence that the 200 pounds are close to the economic limit of use. Calculating a removal of 2.2 pounds K_2O per ton of mill cane, a 40-ton crop would carry away 88 pounds. One hundred and eighty-three pounds of 48 per cent goods would furnish this, and the 200 pounds would give 8 pounds to spare. Thus the original content per acre 6 inches, totaling about 1,000 pounds with 60 pounds exchangeable, need not be touched except in cases of yields exceeding 40 tons of mill cane.

(1) Aarnio, B., 1927. Influence of Absorbed Ions on Soil Reaction. First Ing. Cong., Soil Science, Vol. II, Comm. 2, pp. 65-76.
(2) Hilgard, Soils.
(3) Burgess, Hawaiian Sugar Planters Assn., Agric. Series Bul. 45.
(4) Analyses of soils made at this Station by Dr. W. T. Forsee, Jr.
(5) Allison, R. V., Bryan, O. C., Hunter, J. H. Bul. 190, Univ. of Fla., 1927. The Stimulation of Plant Response on the Raw Soils of the Florida Everglades Through the Use of Copper Sulfate and Other Chemicals.

Thanks for reading and making suggestions are extended to Drs. J. R. Neller and W. T. Forsee, Jr.

Three Out Of Four Corn Growers Use Fertilizer

RECORDS of 1,813 of Indiana's best corn growers, whose yields were checked in the Five Acre Corn Club last year, show that three out of four growers reporting used fertilizer on corn. These are the men, say the agronomists of Purdue University, who are making a special study of the best practices to follow in successful corn production in this State, and what they do may be taken as a safe guide to follow. The percentage of Five Acre members who use fertilizer on corn has increased each year from a low of 36.3 per cent of the growers in 1933 up to 74.3 per cent in 1940.

Another point on which these good corn growers seemed to be in general agreement was that of the best method of applying the fertilizer for corn. Last year 99.9 per cent of the growers applied all of their fertilizer in the row or hill through the use of a fertilizer attachment on the corn planter. In most cases the fertilizer was placed in bands on either side of the hill or row and not actually placed in with or directly above the seed. Ten years ago many of the growers applied all of the fertilizer broadcast, or part in the row and part broadcast. But the rapid improvement in equipment for applying fertilizer near the row or hill, without injury to germination, has brought farmers to adopt this method of placement.

Another change that has taken place in the matter of using fertilizer as practiced by Five Acre Corn Club members has been in the analyses used. In 1931, 68 per cent of the growers used complete fertilizer for corn and 30 per cent used phosphate and potash mixtures. Last year these figures were practically reversed when 27 per cent of the growers reporting used complete fertilizer and 70 per cent used mixtures of phosphate and potash. Evidently these good growers are becoming convinced that nitrogen in addition to phosphate and potash for row application is not the most profitable.

Growers are in rather general agreement on the amount of fertilizer to apply in the row or hill for corn as 75 per cent of them used 100 pounds per acre or less, 21 per cent from 101 to 150 pounds, and the remainder 151 pounds or more per acre.

Almost all growers reported increases in yield from the use of fertilizer, the average estimated increase being 12.3 bushels per acre.

In addition to the increase in yield, growers were almost unanimous that fertilizer advanced maturity of the crop and the average estimates were 9.9 days earlier.

Practices Compared

How do these practices of farmers compare with results of experiments conducted at Purdue? In a fertilizer experiment conducted on the Soils and Crops Farm near Lafayette, for a period of seven years, it was found that fertilizer was most efficient and yields greatest when both fertilizer and corn were hilled. Broadcasting all of the fertilizer for corn was the least efficient method of application. Drilled corn gave larger responses to drilled fertilizer than hilled corn. To obtain the same increases in yield from fertilizer on drilled corn as on hilled corn, it was necessary to double the rate of application. The most profitable treatment was from 63 pounds of fertilizer applied on both sides of the hill, which gave an average increase of 14.5 bushels per acre. Although 125 pounds of fertilizer in the hill gave only slightly greater increases than 63 pounds, it should be pointed out that the smaller application did not compensate for the extra plant food removed by the increased production.

Large numbers of experiments con-

ducted throughout the State over a period of years show no increase for the usual application of nitrogen in addition to phosphate and potash when applied in the hill or row.

On the basis of information now available, it is recommended that a fertilizer containing both phosphate and potash is best under most conditions. The ratio of phosphate to potash will vary from a one to one to a two to one ratio, except on the mucks and black sands where the potash percentage should be from two to three times that of phosphate. The amount of fertilizer recommended for hill application, using modern equipment, should vary from 100 to 150 pounds and for row application from 200 to 250 pounds per acre. The use of the quick soil test for available phosphate and potash is a helpful guide to proper fertilizer analysis to use for corn.—*Purdue News Service.*

The Loud Bassoon

(*From page* 5)

with the customers. When an Indian chief gives anything valuable away he insists on having a chance to tell the world how generous he is. Am I less than an aborigine? Must I thrust this Present at the groom without saying, "It's only a slight testimonial of my regard, but I hope you'll like it!" But as he didn't have the consideration to ask me for her in the first place I presume silence is consent with me.

Of course, he might come back at me and claim it isn't simon-pure generosity after all; because according to the unwritten law of matrimony the burden of gewgaws and groceries descends upon the shoulders of the groom. And as I have no dowry to bestow, he could accuse me of looking to the windward on the financial horizon prior to the next tax levy, which, as I am led to believe, will be a levy to end all levies. But if he lands in the selective service before the year is out, I may get my gift back again for awhile—either singular or plural.

PARTS of the precious remarks I intended for the bridegroom may be set down as a means of winding toward the close of this essay. I feel that they may do some of you as much good as they might have done him.

I do not believe that romance should be confined to balmy nights of June or faded knights of heraldry. It ought not be laid away amid crumbling rose petals and beaded slippers just as an old epitaph on forgotten dreams. Speaking as one who has sometimes overlooked sending flowers to the wife on wedding anniversaries, I believe that flowers often are as sustaining to life as groceries. Affection plus recognition with a nosegay is better than affection taken for granted, and nothing else but.

No true woman ever gets beyond the romantic stage, but she hates to have to mark the calendar to remind him of coming marital milestones. I know there is grave danger for the husband in forgetting those occasions, but sudden and unforeseen attacks of romance are apt to make a wife suspicious, so there we are, caught between the horns of a dilemma. Acute romance at unexpected intervals is not so stimulating as the chronic kind that stays with you to the end.

If it is true that all the world loves a lover, it is likewise true that tenderness and constancy in the elderly wedded couples are the best proof of the pudding. When my bride and I went on our honeymoon we saw a grandpa proudly tender a bouquet to his faded spouse. We saw him help her over the rough places and find her a sheltered seat. My little spouse confided in me then and there that she hoped my ardor and devotion would

be as lasting on the down grade as when we saw the sunrise on our wedding morn. I have never forgotten that admonition, and she has done nothing on her part to make that sentimental treatment less probable.

Pink cheeks, glowing eyes, and curving figures do not last forever. They are only the tempting preface to the chapters of a textbook of many devious pages, often hard to read and sometimes difficult to understand.

MAYBE the lack of proper hymeneal education in America is the cause of so many poorly mated couples who fail to carry the spark of romance toward their golden wedding day. From the time when adolescents are told that sentiment is "silly" to the time when the judge fixes the alimony, what sort of conjugal curriculum do we provide for maturing youth?

Thus far, next to nothing, except the litter of trash and filth which disgraces the average drug store window. We have experimental colleges and doctors galore in liberalism; we have professors of eugenics and genetics, stressing the biological above everything else like certain conquerors abroad; we have authorities on weight reduction, camp cookery, and hooked rugs—but we lack a complete and intelligent course in things that underlie the making of happy wedded life. Some students matriculate in romance languages and musical harmony, but they are often deaf and dumb to both things after they hasten from the altar.

I am never done wondering, though, how successful and promising so many young married pairs seem to be in the midst of a nation that puts its sentiment in cheap magazines and loads the news with the horrors of war. I think we owe them a heap of credit for going along minding their own business and keeping sweet and dutiful when so much of their preceding generation has gone haywire.

We can't stand up and preach to the young folks about the rigors and virtues of a self-sacrificing era of pioneers, pointing out to them how much they have to cheer them compared to the settlers of the wilderness. That is, we can't do that and keep a solemn face. It won't soak in very far, because the kids know right well that the present era is one of the toughest mix-ups it has been the misfortune of mankind to behold. I honor and reverence the twain who lock arms and start the wedding march amid the roar of impending guns or the uncertainty of economic bombing. It shows that they have the will and the courage to carry on under the banner of love and hope and youth and romance and work, facing the ill wind as calmly as the zephyr, believing that in time the world will come to its senses and the next generation will have lasting peace.

NO, I AM not going to disturb the great day with any such croaking or bemoaning. I shall pull on my pants, yank my tie into fairly decent shape, comb my thinning locks, and brush my coat and vest with extreme care. It will do no good to cloud their glory with any lamentations. They are aware of things that stand in the way to happiness, and they know Mother and I wish them well and had nothing to do with all this conquest and confusion. We are all just straws in the hurricane, hoping to land somehow right side up in some familiar field. This may be "defeatist" in tone but it is not so intended. He who knows his limitations and wants to enjoy his little to the fullest can never be accused of welching. He is merely freshened and prepared for anything that comes, so long as love and romance may live yet a little longer in the Land of the Leal.

And live it will, for no country has a sturdier and a better nourished zest for love and liberty than ours. Its foundations rest upon the home. I shall be proud and happy to help lay the foundation for just one more of many homes that you and you and the rest of you are planning to consecrate in this sweet and serious summer.

Jockey (who has just won the Kentucky Derby)—I just kept whispering in my horse's ear a little poem I made up—"Roses are red, violets are blue, horses what lose are made into glue."

MEMORY

The story is told of the Kentucky colonel who had an argument with the devil. The devil said that no one had a perfect memory. But the colonel maintained that there was an Indian on his plantation who never forgot anything. The colonel agreed to forfeit his soul to the devil if the Indian ever forgot anything.

The devil went up to the Indian and said: "Do you like eggs?"

The Indian replied, "Yes." The devil went away.

Twenty years later the colonel died. The devil thought, "Aha, here's my chance." He came back to earth and presented himself before the Indian. Raising his hand, he gave the tribal salutation, "How?"

Quick as a wink the Indian replied, "Fried."

Liza: "Dey says dat young niggah Exodus Johnsing done got a terrible position wiv de army."

Mandy: "Is dat so? What sort ob position is it?"

Liza: Why, dey says he's done attached to a flyin corpse."

Stern Parent (to applicant for daughter's hand)—"Young man, can you support a family?"

Young Man (meekly)—"I only wanted Sarah."

Little Girl (to policeman): "Can I trust you?"

Copper: "What?"

L. G.: "Can I trust you?"

Copper: "Why, certainly, all little girls can trust policemen."

L. G.: "All right, then, please button my panties."

. . . The preacher finished his sermon with "All liquor should be thrown in the river," and the choir sang "Shall We Gather at the River?"

THE YOUNG FOLKS?

First Old Timer (in a thin, piping voice)—"Say, Lem, ye reckon thar's as much spoonin' going on as thar used to be?"

Second Old Timer—"No, Henry, don't seem that they be."

First Old Timer (after a thoughtful pause)—"Don't quite agree with ye thar. I calc'late thar's just as much of it goin' on, but I 'spect it's a different crowd what's doin' it."

Dear Tom:

Come tomorrow evening sure. Pappa is at home, but he is laid up with a very sore foot. See? Mary.

Dear Mary:

I can't come tomorrow evening. I'm laid up on account of your father's sore foot. See? Tom.

Getting the baby to sleep is hardest when she's about eighteen years old.

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